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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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CONTENTS

ASSOCIATION ACTIVITIES

The present issue of the BULLETIN gives a good idea of the various activities of the Association and of the zeal and energy with which its work is carried on by a large and growing membership. The contents of this number are supplemented by the Index of the preceding volume, which tells its own story as to what has been done in the past year, and reveals a very wide range of subjects coming within the scope of treatment and consideration, chiefly through the intervention of the numerous committees, or the meetings of the company sections. Particular attention may be directed to the *Question Box* index, revealing the extraordinarily large number of topics on which information was sought, and in regard to which valuable facts and data were contributed from all sources and massed together by the able editor of the *Box*.

With the present new volume, it may be noted, a new editor takes hold of the *Question Box*, carrying forward the plans of his predeces-

sors, and aiming like them to improve the work and enhance its value to members. One new feature has been to put in a separate group in each issue, the new questions, so that they may be readily referred to and distinguished from questions asked in previous issues.

It will be seen also by reference to the last page that great advance has already been made in the formation of committees. In fact, some of the new committees are already busy and have had sessions. The committee work of such an Association as ours is vital to its welfare and usefulness, and the enthusiasm that is brought to bear on it each year is one of the reasons why the Association is so influential in the art and industry, and so successful in leading the way to the adoption of higher standards of practise.

In membership, the Association is maintaining the gains of the past twelve months, when a record was achieved without precedent in the history of engineering and industrial societies. Even the dull summer months have, as will be observed, brought a large influx of new members; and it is believed that the coming season will see the membership carried to far higher figures than ever. The suggestion is made that as to membership, the matter is one where every present member can and should consider himself on the committee, and should help to secure recruits. It stands to reason that the larger the membership, the lower the unit cost per member at which fuller service can be rendered. It is equally evident that as the Association approximates more closely its possible membership—which today it is far below—the nearer it comes to reaching the full measure of its influence and responsibility. Here is a field in which we can all work together.

The Standard Classification of Accounts

The Committee on a Uniform System of Accounting, Mr. John L. Bailey, chairman, has just issued in a neat and handsome volume the Standard Classification of Accounts adopted by the Association in 1908 and 1909, and recommended for the use of all member companies. A number of companies are already using the system, and its adoption by all others at an early date is strongly urged. The book is 9 by 6, *i. e.*, octavo size, 129 pages, with an introduction and an index; and the classifications and items are clearly set forth in plain, bold type. The volume is bound in two, but uniform, styles. To Class A member companies one copy is being sent free, bound in flexible red leather. The other edition is bound similarly, in stiff red cloth; both editions having red edges. The cloth edition is issued at $1 per copy and can be purchased by members so long as the edition of 750 copies lasts. There

is already an active inquiry for it; and it is believed that many Class A companies will also want to secure several extra copies in this form. It is requested that orders should be sent in promptly. Each free copy has been sent with a return postal acknowledging receipt; and it is earnestly requested that these be used and also that any case of non-receipt be reported to the Association office.

In connection with this work, Mr. Bailey is issuing a circular directing attention to the subject, and also propounding a series of inquiries as to the proposed creation of a Statistical Department of the Association, to which a synopsis of monthly or annual statements could be forwarded for tabulation and interchange among member companies adopting and using the standard system of accounts. It is again earnestly requested that member companies will give this subject their best attention, and place the committee and the Association officers in position to determine wisely this important question.

Warning as to Gasoline

Mr. W. H. Blood, Jr., the insurance expert of the Association, furnishes the following important note:

Those who are familiar with gasoline know what a dangerous explosive fluid it is. In many cities the storage of it is subject to almost as severe regulations as is the carrying of gunpowder.

Fire Commissioner Johnson, of Nebraska, has recently thought it wise to inform the public throughout his state as to the danger of carrying gasoline in stock, and he has therefore sent out a warning to those who keep gasoline in stores. The closing paragraph of his warning is worthy of special attention and may be of service to the members of the National Electric Light Association who are troubled with gasoline lighting competition. It is as follows:

"The carrying of gasoline in the stores will be declared a nuisance, and we warn the merchants handling this dangerous merchandise that they must take steps to protect their property and their neighbors' property, as well as their own and their neighbors' lives, or suffer the expense of defending themselves from criminal prosecutions for maintaining a fire nuisance."

COMMONWEALTH EDISON MERIT SYSTEM

Below is given in full the "Merit System" which is now being tried by the Commonwealth Edison Company of Chicago, dating from April 1. It will be of great interest to all other member companies.

For the purpose of better recognizing faithful and competent service, the company hereby establishes a Merit System, which shall be conducted as hereinafter specified:

Section 1. The administration of the Merit System shall be vested in the Advisory Committee, acting through its Sub-Committee on Employees.

Section 2. The Merit System shall apply to all employees on the semimonthly or monthly pay-roll receiving less than $2,000 per year; also to all employees on the weekly payroll who have rendered more than six months of continuous service.

Section 3. The scale on which employees' records will be marked shall include both merits and demerits, and under each heading and subheading one or more merits shall offset an equal number of demerits.

Section 4. An employee's record shall be divided into three principal parts, and each part shall be marked separately. These three parts, and their relative values in a perfect record, shall be: punctuality, 13 per cent; attendance, 20 per cent; performance of duty, 67 per cent; total, 100 per cent.

Merits and demerits shall be marked under each of these headings above or below what shall be taken as a "fair" record.

Section 5. Punctuality shall be based on daily record in which the percentage of perfection shall be the ratio of days on time to working days in the particular class of employment. Allowance shall be made for tardiness of employees, when excused on the recommendation of their immediate superior, by the head of their department, for any of the following reasons: 1—Tardy on account of company's business; 2—Illness or disability contracted in the company's service; 3—Death in immediate family.

Grading for each quarter, or a period of three months, shall be as follows: 100 per cent, 2 merits; 99 per cent, 1 merit; 98 per cent, 0 merits; 96 per cent, 0 merits; 92 per cent, 4 demerits; 84 per cent, 12 demerits.

Other points (merits or demerits) by interpolation. Should fractional percentages result where grading is a matter of statistics, one-half or greater fractional percentage shall be taken as the next higher percentage, and less than one-half shall be taken as the next lower percentage, as, for instance, 98.5 per cent shall be 99 per cent. Should fractional merits result, they shall be taken in the same manner as fractional percentages.

Section 6. Attendance shall be based on daily record in which the percentage of perfection shall be the ratio of total days at work to total working days for the particular employee in the three months period. Allowance shall be made for absence of employees, when excused on the recommendation of their immediate superior, by the head of their department, for any of the following reasons: 1—Absence on account of company's business; 2—Illness or disability contracted in the company's

service; 3—Death in immediate family.

Grading for each quarter, or a period of three months, shall be as follows: 100 per cent, 3 merits; 99 per cent, 2 merits; 98 per cent, 1 merit; 96 per cent, 0 merits; 92 per cent, 6 demerits; 84 per cent, 18 demerits.

Other points (merits or demerits) by interpolation; fractional percentages and fractional merits to be treated the same as under Section 5.

Section 7. Performance of duty must necessarily be based on the judgment of each employee's immediate superiors as to the character of work done or not done by the employee. As the duties will vary greatly in the different departments, each head of department will, subject to the approval of the Employee's Sub-Committee, select such subheadings from the following list and assign such relative importance thereto as the conditions in his department may warrant.

Receptiveness: Ability, effort and success in grasping information, orders and instructions.

Application: Industry, conscientious and persistent effort.

Courtesy: Written or spoken language, manner and action in every way to public or fellow employees.

Loyalty: True to interests of company.

Accuracy: Avoidance of mistakes which cause expense, delay or annoyance to the public or to company.

Speed: Not haste, but relative time in which given duties are properly performed.

Reliability: Faithfulness, always ready and willing when wanted, and in good physical condition.

The total grading for each quarter or period of three months for the aggregate of all or such of the above subdivisions under Performance of Duty, as may be selected by any head of department, shall be: Perfect, 100 per cent, 10 merits; very good, 96 per cent, 6 merits; good, 92 per cent, 2 merits; fair, 85 per cent—80 per cent to 90 per cent, 0 merits; poor, 70 per cent, 10 demerits; very poor, 55 per cent, 25 demerits.

Other points (merits or demerits) by interpolation.

Section 8. Each foreman or head of sub-department shall recommend quarterly, on form provided, a grading, as outlined in the preceding three sections, of all employees under his charge, which grading shall be based upon the best and most accurate information obtainable. This recommendation shall be forwarded to his superiors, and, after approval or corrections, through the regular channels to the secretary of the Advisory Committee, who, after the grading has been fixed by the Employee's Committee, shall enter such grading in the permanent Employee's Record File.

At the end of each calendar year, all records shall be closed and balanced, and no balances shall be car-

ried forward into the following year, but the net result under each of the three principal headings, as set forth in Section 4, shall be made a matter of permanent record for each individual year.

Section 9. Any employee, upon application to the secretary of the Advisory Committee, shall be given a copy of his merit record; if he should be dissatisfied with the markings thereon appearing, he may apply in writing to the head of his department, stating wherein he believes an injustice has been done him, and asking for a revision of his marking; and if said application shall contain a reasonable indication that a material error may have been made in the marking, the Employee's Committee shall, at the request of the head of his department, properly and diligently ascertain the facts and correct any error which may be discovered, or reaffirm its former decision.

Changes of Address

The annual *Proceedings* are now in the printer's hands, and such good progress has been made as to warrant the hope that they will be ready early in October. It will be remembered that they contain each year a list of all members in good standing; and the list is already being put into type as of September 1. Any member who has changed his address should notify this office promptly, not only to secure correct registration but to enable the office to forward the *Proceedings* to the proper place. Every year delay and trouble occur on this point, and conditions sometimes become peculiarily complicated when, as happens, a member moves four times in the year, but conceals the fact most sedulously from headquarters. It is nice to be credited with lots of ability, but these changes of address cannot be guessed at on any ordinary basis of intuition; and the only thing possible is to send the literature to the last address recorded on the membership card.

Proposed Underground Wires for Pawtucket, R. I.

The town of Cumberland, Rhode Island, served notice this summer on the Pawtucket Electric Company that it was the sense of the voters in Cumberland (a suburb of Pawtucket) that the electric light wires should be put underground, and the company was required to appear on August 4 and show cause why the order should not be complied with.

Mr. W. H. Blood, Jr., insurance expert of this Association, appeared for the Pawtucket Electric Company and presented many facts which were of surprise and interest to the council. It was shown that to comply with the order would require an expenditure by the company of $100,000 for conduits and wires. To pay 6 per cent interest on this investment would require $6,000 per year. The company's present income in

this territory is a little over $9,000 per year, $6,000 of which is derived from the street lights, and the company is under a five-year contract with the privilege of renewal by the city at the same price for another five years. About $3,000 comes from the commercial customers. There being no opportunity for raising the price of the street lights, the only recourse the company would have to make good the interest on the additional investment would be through raising the rates charged the commercial customers; in other words, the present income of $3,000 would have to be raised $6,000, or to $9,000, in order to take care of interest charges. This would mean that the commercial lighting rates would have to be three times as great as they are now, or the rate would have to be raised from 14¼ cents to 43 cents.

Mr. Blood submitted data showing the conditions existing in all of the cities in Massachusetts, which confirmed his statement that to require the company to place its wires underground in Cumberland, which is strictly a mill village, would be unwarranted and not in accord with common practice in the towns and cities in Massachusetts, where the æsthetic point of view was the more important feature.

Diagrams of many of the large cities of the United States, showing the ratio of the total area of these cities to the underground portion, were submitted and the impropriety of placing 75 per cent of the wires in Cumberland underground was clearly demonstrated.

The town council has taken the matter under advisement, and it is confidently expected that, in view of the fact of its lack of knowledge of the extreme cost of the undertaking and the effect which it must necessarily have upon the rates, the order will not be enforced.

The New Committees

On the last page of this BULLETIN will be found the organization and members of the new Committees. There are many changes to be noted, both in the Committees themselves and in the individuals constituting them. The list is not quite complete as will be seen, but has been carried by President Freeman and the various chairmen as far as possible during the summer.

The Bulletin

The present issue of the BULLETIN is a double number, embracing the issues for August and September. It contains also the index for the last volume, in separate form, so that if desired the volume can be bound, or if left unbound can be referred to easily in regard to any item of interest. As will be seen, the present issue also begins a new volume, namely, Vol. 4. During its short career, the BULLETIN has been found of increasing usefulness, and is now indispensable.

Meeting of Rate Research Committee

As a result of the presentation of Mr. S. E. Doane's paper on high efficiency lamps and rate-making, at the St. Louis convention, a committee on rate research was appointed to pursue further the inquiry for data affecting the vital subject of central-station rates for electrical energy. This committee had a meeting at the Association offices on September 2, when the following were present: Messrs. John F. Gilchrist, chairman, S. E. Doane, W. H. Winslow, R. S. Hale, L. H. Conklin, and Arthur S. Huey. The whole day was spent in the discussion of the subject, and it was arranged that Messrs. Gilchrist, Huey and Winslow will have another meeting in Chicago soon to formulate a series of questions to elicit data from member companies on the points involved. The committee expects to secure and put together some very interesting and useful information.

Lower-Priced Meters

We are requested by Chairman Sawin to state that, as promised at St. Louis, the Meter Committee has kept in close touch with the manufacturers with reference to a lower-priced meter, and is now in a position to state that the General Electric Company is making rapid progress in the development of a new alternating-current meter, which will be sold at a lower price than the present "Type I" meter. It is confidently expected that the new meter will be available to the members within the next six months. The committee hopes to be in a position to give details on prices at an early date.

NEW MEMBERS

Class A: Central Mexico Light and Power Company, Colorado Springs, Colo. H. M. Byllesby and Company, Chicago, Ill.; Washington (Ill.) Light and Power Company; Fort Dodge (Iowa) Light and Power Company; Suffolk Gas and Electric Company, Bay Shore, N. Y.; The Rio de Janeiro Tramway Light and Power Company, New York City, N. Y.; Staunton, (Va.) Lighting Company.

Class B: Edison Electric Illuminating Company of Brooklyn—A. Black, Otto H. Buescher, H. A. Bunce, Eugene P. Conmy, Cornelius A. Dargan, Michael A. Dooley, Jerome Gerson, Carl Halm, Charles C. Hommann, Jr., August H. Iber, Wm. H. Lock, John G. McNelus, Wm. M. Magee, Joseph Ramsey, John P. Smiley, Charles Sprague, Jr., Robert R. Stone, Beverley T. Taylor, Edward Thake, John E. Wallace, W. B. Weir.

Fall Mountain Light and Power Company, Bellows Falls, Vt.—J. B. Crandon.

Cataract Power and Conduit Company, Buffalo, N. Y.—James E. Byrnes, Henry Rycroft.

Commonwealth Edison Company, Chicago—A. F. Bronwell, A. C. Duncan, W. A. Dunn, R. A. Ward.

North Shore Electric Company, Chicago—Walter B. Allen, C. H. Burns, Thomas M. Combiths, Harry Elenbaas, S. M. Esler, Hans Hansen, A. M. Klein, O. L. Lynch, R. B MacDowell, Alfred Underdown, M. L. Wright.

Summit County Power Company, Denver, Colo.—E. C. Reybold.

Public Service Electric Company, Newark, N. J.—Edwin T. Barclay, Adolph M. Berg, J. A. Boell, George Comer, William H. Foose, Aloysius D. Fox, M. A. Groom, William A. Mills, C. H. Randall, Martin Schreiber, H. G. Smith, Wm. T. Walsh.

New York Edison Company—Lucien Kahn.

United Electric Light and Power Company, New York City—F. H. Abeel, John C. Donnelly, Jr., Joseph Roland Hughes, John L. Lufkin, James O'Brien, John J. McCarthy, Charles E. Marks.

Electric Light and Power Company of Abington and Rockland, No. Abington, Mass.—Arthur H. Robbins.

Philadelphia Electric Company—Henry F. Hofmann, Jr.

Consolidated Electric Light Company of Maine—Stephen T. Heath.

Westboro (Mass.) Gas and Electric Company—John J. Hynes.

Class C: Alton D. Adams, Arthur H. Ford.

Class D: American Laundry Machinery, Rochester, N. Y.; The R. Thomas and Sons Company, New York; Hubbard and Company, Pittsburgh, Pa.

Class E: Pettingell-Andrews Company, Boston—William A. Peterson. *Okonite Company, New York City*—Lewis G. Martin. *R. Thomas and Sons Company, New York City*—R. W. Harms, H. R. Holmes, M. P. Maxwell, J. E. Way.

Meter Care in Small Stations

At the recent meeting of the Michigan Electrical Association, Mr. A. M. Richardson, of Ann Arbor, read an interesting paper on the maintenance of meters by small stations. The first essential of a system of keeping meters accurate, he said, is a certain definite part of a certain definite man's time. The work is essentially that of a specialist, and should with all other meter work be concentrated in one man's hands, thereby enabling him to get all the experience possible, and fixing the responsibility. His main possession should be: experience, intelligence, interest in the work, reliability and good standing in the community. The second essential is the headquarters for this department. A room must be set aside for the purpose of storing and testing meters.

One inexpensive scheme is to mount on the test board an ordinary meter that has tested out perfect, and thereafter use it for the sole purpose of checking the test instrument. The question of extreme accuracy need not be considered at the present time, when all available data indicates that outstanding meters average 8 per cent slow. A meter found on test within 1 per cent of perfect should be let alone. In testing a meter a portable loading device will be required, as it saves much running about on the customer's premises. Suitable printed forms must be provided for recording the results of the tests, using stiff paper to allow writing when held in the hand, and for vertical filing. Meter readers appreciate having meters in convenient locations. Meter testers appreciate this still more, and the quality of the meter testers' work will depend very much on the convenient location of the meters which he has to test.

The consumer's connected load is sometimes changed, and it is the duty of the meter tester to note this, and order a suitable change in meters. It seems a general and good practice to install meter equipment for 60 per cent of the residence connected load, and 100 per cent of the business load, using no single meter, however, under five-ampere or over 50-ampere rating. Where the load is greater than 50 amperes, use should be made of a five-ampere meter and suitable series transformers, thereby allowing testing with ordinary equipments.

NEWS OF THE SECTIONS

FORMING AND UTILIZING COMPANY SECTIONS

One of the most interesting sessions held at the great St. Louis Convention was that devoted to the work of the company sections. Men who are interested in such section work in all parts of the country participated in the discussion under the leadership of Messrs. Doherty and Eglin, and the immediate result was the production of a great deal of evidence as to the value of the company section and a great stimulus to the work.

There are many central-station executives who could introduce the company section idea with immediate and direct benefit to their companies, and we would strongly recommend them to read that portion of the annual *Proceedings* as soon as the St. Louis report is available. If they have any lingering doubts on the subject, we feel sure that such doubts will vanish. In fact, the company section is one of the best plans yet developed for educating the company's forces, for cultivating the sense of a common interest, and for intensifying the sentiment of loyalty and solidarity; and we hope to record the formation of many new sections the coming season as well as the enlargement in scope and membership of all the existing ones.

Niagara Trip of Buffalo Section

The Buffalo Section had a very pleasant trip to Niagara Falls on July 23. A special car took the party direct to the power-houses of the Niagara Falls Power Company and of the Ontario Power Company; and the men spent the afternoon in seeing where and learning how the electrical energy is developed with which they have to deal in lighting the streets and running the factories and cars of Buffalo.

Getting Together in New Orleans

Mr. Mike S. Hart, the urbane and energetic manager of the Consumers' Electric Company of New Orleans, is very much interested in the question of organizing a local section for that city. In the meantime this member company has formed an association among its employees, which meets the first Monday in every month, and which had its initial meeting in August with 38 in attendance. The company has given the use of one of the floors of its building, and has gone to the expense of equipping it as a library and meeting room; and all expenses of the association are borne also by the company.

The objects of the new body are

to promote the welfare of the employees and broaden their knowledge of the central-station art. A benevolent feature has been added, in the payment of dues of 25 cents per month by the men, the fund thus created to be disbursed only for benevolent or charitable purposes among needy members.

It is planned to have a lecture on some interesting topic, which will last about an hour, and then the remainder of the evening will be devoted to some social or entertainment feature. The first effort of this kind was highly successful, the lecture being upon the interesting points of the electric meter, aided by demonstrations with various types of meters.

Meeting of the Utah Company Section

The thirteenth regular meeting of the Utah Light and Railway Company Section was held at the company offices Wednesday, June 29. Mr. B. W. Mendenhall, chairman, gave a very interesting talk on the convention held at St. Louis, after which the election of officers for the coming year was in order. The following officers were elected: Wm. M. Scott, chairman; C. L. Archer, secretary-treasurer; D. B. McBride, C. J. Jenkins, executive committee; Allan Maughan, Will Emery, committee on papers and *Question Box*.

It was also resolved that Article 3, Section 2 of the constitution be amended to read, "that all associate members be eligible to any office of this association." A committee of three consisting of A. Maughan, B. W. Mendenhall, and Lloyd Garrison was appointed to prepare other amendments in the constitution.

A Moonlight Outing at St. Louis

On July 28 the Union Electric Light and Power Company Section and their friends, about 600 in all, enjoyed a moonlight Mississippi River trip on board the steamer "Alton," chartered for the occasion.

Some enjoyed the well-selected dancing programme, while others preferred to gather in groups and avail themselves of the hospitality of the refreshment committee, together with the cool river breezes.

Good fellowship prevailed throughout the evening, despite the fact that the company's commercial engineer, Mr. F. D. Beardslee, did not dignify the occasion by his presence. He pleaded "not enough tickets to go around," and farming duties. Anyhow, he paid very cheerfully.

The success of the trip was shown by the prevalent question afterward —"When shall we have the next one?"

On September 28, at Brandon, Vt., the Vermont Electrical Association is to dedicate a tablet to the memory of Thomas Davenport, the "village blacksmith," who in the early thirties built electric motors, operated model electric railways and drove printing presses by electrical energy. The State and the Association, which is part of our New England Section, do well to honor the memory of this American pioneer of the electric motor and electric power supply.

The Value of Section Membership

President Freeman has a signed article in the September *Bulletin* of the Brooklyn Edison Company Section on this subject, and says:

All that a good man needs to attain a reasonable measure of success is opportunity both to learn and to demonstrate. The company section, I believe, can be made to fill the bill. The information which is made available to every member through the literature which is received, and the discussions at the meetings, is very adequate and comprehensive, and no one who is intelligent and industrious need be ignorant as to the underlying principles of our business, and its methods of operation. No other means of education that is as complete or as easily attainable has ever been offered to the company employee, and failure to take advantage of the privilege can only be due to a lack of appreciation of its value.

Combined with the opportunity for practical education, the section offers equal opportunity for demonstration on the part of the employee of the practical application of the instruction received. In a large organization every opportunity that can be embraced to demonstrate one's capacity for initiating ideas and applying them to practical purposes is of distinct value. This does not, of course, mean that the man who makes himself most prominent at the meetings is making the best impression. It is as easy, and sometimes easier, to make the mistake of talking too much, as of saying too little, but the man who is able to show that he knows how to say or do the right thing at the right time has a splendid opportunity for demonstration in connection with the company section work.

The National Electric Light Association embraces in its membership all of the progressive and successful companies, and the successful men in those companies. It represents the organization of the electric lighting industry throughout the continent. It is pleasant to feel that one, however humble his present position may be, is able to identify himself with this representative organization as fully as can the most prominent men in the industry, and avail himself of all the privileges and advantages at a cost which is within the reach of all.

Realizing the desirability of such participation and the indirect benefit to the company resulting from the increased efficiency of service, the company is glad to make it as easy as possible for every employee to join the Association through advancing the dues and allowing the employee to pay the same back in installments.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at the above address.

Matter intended for publication in any particular issue must be in the hands of the Editor not later than the 28th of the preceding month.

Answers will be published as soon as received.

Since lack of time and space may make some omissions necessary, the Editor reserves the right to publish only what time and space permit, and what in his judgment is for the best interests of the Association. In general, preference will be given to questions over answers, but where it is not possible to publish answers these will be mailed to the member asking the question.

The object of the Question Box is to keep members in touch with one another's work and to do it promptly and efficiently.

Suggestions and criticisms tending to improvement are invited.

HELP WANTED

The new editor of the "Question Box" requests the conscientious and continuous co-operation of all members of the Association. Not only so, but he herewith makes a special plea to each member, asking that when the BULLETIN is received each month time be taken to scan all questions and to reply to those about which special information is possessed. It is only by the help of those who know and are willing to tell that an institution like the "Question Box" can attain its maximum of usefulness to the member companies and continue to be a credit to the Association.

It will not do to leave this work "up to the other fellow," for in that event he will surely leave it "up to you." It ought not to be too much to ask any member to furnish information of which he is possessed to another company or companies requiring such information for the better conduct of their business. It is either thoughtless or careless, or both, to withhold the same. The very essence of the Association's function, in fact the only logical reason for its existence, is mutual helpfulness, and there is no more effective or appreciated method of proving helpful to fellow-members than is provided through the medium of the "Question Box."

This is not a scold; it is an appeal, and your new editor feels that it is called for by the conditions. A glance through the last issue of the "Bulletin" will show that, out of a membership of nearly 6000, just 27 members replied to 57 questions. These members show the true spirit of helpfulness and are entitled to proportionate credit; further it is realized that not all members are in position to reply to all questions; but it is impossible without securing a general symposium on certain subjects to furnish adequate information on important topics, and replies on such topics should be readily forthcoming.

For instance, the question is asked concerning free lamp renewals: "What percentage of lamps returned by customers are found to be of their rated candle-power? Are these lamps returned to service? What is the method of determining their candle-power?" It would seem as if a number of replies from separate sources might be expected to a question of this kind, yet, though twice published, only one reply actually came to hand. Now, this is really no kind of service to supply a member company. If **you**, reading this now, had asked a question of this type, you would not be satisfied with one reply, which, valuable as it is, can give you no line on general practice. No; you would have considered your fellow-members niggardly or careless in not supplying the information asked. Yet the reason for this dearth of communication was, doubtless, rather lack of interest than lack of willingness.

Examples might be multiplied. One other will suffice.

A member company states that it "has on its lines a department store with 60 horse-power in motors and 80 horse-power in lights (connected load) and for business-holding purposes" requests information from other companies as to rates and practise as applied to similar installations. This question appeared three times, but only two replies were received, one coming from the same gentleman that supplied information concerning lamp renewal practise. The question was first published in the April issue, but no reply was made until the June number. This seems hardly a fair, certainly not an adequate, return to a bona-fide appeal for help from a member company. It would seem as if we might without straining extend a little more aid and a greater degree of helpfulness toward the central station asking a question of such vital importance in its affairs.

Co-operation is the keynote of the success achieved by our industry and by this Association. Your new editor believes that all members are willing to extend their full share of such co-operation, and he hopes that it will be only necessary to call their attention to its necessity in connection with the "Question Box" to receive it in full measure. No man should be too big or no man too small to willingly ask or answer questions leading to information of advantage to the industry. If we all turn in, and each does his share toward making this "Question Box" a real clearing house of authentic and authoritative information covering moot points and general practise, results to the member companies cannot fail to justify the expenditure of time and effort and must prove gratifying to all concerned.

Please begin to help by looking over the questions in this issue, supplying replies to those about which you possess information that may prove of interest or value.

And if there is anything special you wish to know ask questions about it. We'll undertake that the information you seek will be forthcoming.

WARM WELCOME FOR COMMERCIAL QUESTIONS

Questions concerning matters of general policy and questions requesting information on commercial problems and practise have not hitherto been asked as freely or as frequently as might be, and the present editor will warmly welcome such to the "Question Box." Questions relating to the science of the profession, to engineering or operating problems involved in the generation and distribution of current, are at all times of vital interest and real importance. Nevertheless it is true that at this time the subjects making the widest appeal, calculated to arouse the greatest interest and to result in the largest general benefit, are those which deal with the central station in its relation to its customers, present and prospective, to its employees and the general public. Questions concerning equipment or operation are valuable and wanted, and adequate answers to them will be found; but members are especially invited to ask for and to supply information as to how to get and keep business, methods of treating employees in various relations, and of dealing with the public in matters of policy. No feature or phase of these subjects will be sidestepped, and every effort will be made to secure to member companies reliable and useful information.

ANSWERS

O—16. What member companies sell other products in connection with electricity?

The Georgia Railway and Electric Company sell steam-heat.

William Rawson Collier
Atlanta, Ga.

O—17. The filament of a lighted incandescent lamp held in proximity to a high-tension conductor is observed to vibrate violently. This is a reliable test of the presence of high-tension energy. The same thing often happens when an incandescent lamp is placed in proximity to a conductor carrying a heavy low-tension current. Explain the phenomenon.

Any conductor carrying current, whether low or high tension, is surrounded by a magnetic field in proportion to the current. If the current is alternating-current the field will also be alternating. Any conductor placed in this field will tend to vibrate. The effect is more noticeable in the case of a lamp filament, because it is so slender and supported so as to allow of vibration. The vibration of the lamp is a test showing that a current is flowing. The filament will not vibrate if no current is flowing, although cable may be alive.

A. G. Rakestraw
Wilkinsburg, Pa.

If the filament of an incandescent lamp burning on direct-current were held close to a *conductor carrying* a heavy direct current (of

any tension) it would not vibrate but would be either attracted or repelled depending on the direction of the current flow. If either one or both carried alternating-current, of either high or low tension, and not too low current, the filament would vibrate as stated. It is merely a demonstration of the principle of operation of motors. With both carrying direct-current the filament being a conductor carrying current, tries to move as does the armature conductors in a direct-current motor.

A. G. Gibbony
Massena, N. Y.

0—18. An incandescent lamp does not flicker noticeably on 25-cycle energy at normal voltage. If, however, one of the lamp terminals connected to one side of the 25-cycle main, and the other to one side of a direct-current system of the same voltage, the lamp flashes brightly and the flicker is very noticeable. Please explain.

There is an interconnection between the two circuits, else the lamp would not burn at all. If the lamp is connected across the two sides of the circuit that are not connected we will have a circuit in which a direct voltage of 110 volts is superimposed on a circuit of the same voltage alternating. Instead of 110 volts at 25 cycles, or 50 alternations per second, the voltage on the lamp would vary from 0 to 220 volts at only half the alternations, or 25 per second.

A. G. Rakestraw
Wilkinsburg, Pa.

The result you obtained was due to your 25-cycle alternating-current and your direct-current circuits being connected in some way. Normally, you should not be able to get a light at all by making such connections.

The flickering could be caused, or at least affected, by the direct-current generator being driven from the alternating-current supply, or, what is more likely is that your direct-current was from the exciter supplying excitation current for the alternator from which you got your 25-cycle alternating-current and that there is a ground on both.

A. G. Gibbony
Massena, N. Y.

1—7. In a large power-house is it necessary or even desirable to have a clear view of the turbine room from the operating gallery?

There are two opinions on this question, the one side advocating having the operating gallery in full view and the other insisting on keeping it isolated. The advocates of the first mentioned method maintain that in the event of a failure of signals or in case of trouble it is often extremely important for the operator not only to get a full view of the operating room but to communicate verbally with the engineer. The advocates of the isolated switch-house maintain that the operator should be free from all disturbance and noise from the operating room, especially in case of trouble, and say that the operator is much more

likely to keep his head if his instruments are the only indicators of trouble.

The writer believes that a compromise of these two extremes is best and that all advantages of both systems can be obtained where the operating gallery is in such position that the operator can obtain full view of the operating room by opening a door giving access to a balcony, but when the door is closed all noise and danger of escaping steam or other annoyances is cut off.

G. L. Knight
Brooklyn, N. Y.

4—1. What are the effects of moisture in fuel on the thermal efficiency of a boiler?

Water (H_2O) vapor is unstable in the presence of incandescent carbon, and the reaction of $H_2O + C = CO + 2H$ is endothermic or heat-absorbing. Assume 2 per cent moisture and 2½ per cent hydrogen in the coal, .0005 pounds per cubic foot moisture in the air, 225 cubic feet of air per pound of coal, a rise in temperature of escaping gas of 500 degrees Fahrenheit, specific heat of water vapor .480, and heat value of coal 12,500 B. t. u.

2 per cent Moisture in the coal .... =.020 lbs.
2½ per cent Hydrogen, when burned, gives
nine times its weight of water $.025 \times 9$ .... =.225 lbs.
Moisture in the air, $225 \times .0005$ .... =.113 lbs.
Total moisture, $.0020 + .225 + .113$ .... =.358 lbs.
Heat carried off, $.358 \times 500 \times .480$ .... = 86 B. t. u.

$\frac{86}{12,500} = .7$ per cent loss due to moisture.

There are two sides to this question, and if it was asked with the idea in view of wetting the coal it might be figured that wetting the coal to the right degree would effect a saving greater than the loss shown above. Especially would this be the case in firing fine dry slack where a considerable amount would be blown up the chimney or lost through the grate.

T. C. Roberts
Pueblo, Colo.

9—1. What member companies sell steam-heat as a by-product?

The latest statistics on this subject which seem to be available are found in connection with the 1905 Report of the National Electric Light Association Committee on District Heating. This information is not complete nor is it up to the present date, but is herewith appended as likely to prove of some service to the member company asking this question.

Crookston Water Wks., Pr. and Lt. Co.	Crookston, Minn.
Tiffin Edison El. Ill'g. Co.	Tiffin, Ohio.
Renova Edison El. Ill'g. Co.	Renova, Pa.
Grand Forks Gas and El. Co.	Grand Forks, N. D.

Pawtucket Electric Co.	Pawtucket, R. I.
Edison El. Ill'g. Co.	West Chester, Pa.
Birmingham Ry. Lt. and Pr. Co.	Birmingham, Ala.
Peoria Gas and El. Co.	Peoria, Ill.
The Edison El. Ill'g. Co.	Cumberland, Md.
Oskaloosa Lt. and Tr. Co.	Oskaloosa, Ia.
Washington El. Lt. and Pr. Co.	Washington, Pa.
Colorado Springs Elec. Co.	Colorado Springs, Col.
Central Heating Co.	Detroit, Mich.,
Hillsboro El. Lt. and Pr. Co.	Hillsboro, Ill.
Pontiac Lt. and Wtr. Co.	Pontiac, Ill.
Paducah Heating Co.	Paducah, Ky.
Edison El. Ill'g. Co.	Topeka, Kans.
Danville Ry. and Lt. Co.	Danville, Ill.
Georgia Ry. and Lt. Co.	Atlanta, Ga.
Clinton Gas and El. Co.	Clinton, Ill.
Pittsfield Electric Co.	Pittsfield, Mass.
Lima El. Ry. and Lt. Co.	Lima, O.
Springfield El. Lt. and Pr. Co.	Springfield, Ill.
Davenport Gas and El. Co.	Davenport, Ia.
Muncie El. Lt. Co.	Muncie, Ind.
Bristol and Plainsville Tramway Co.	Bristol, Conn.
Citizen's Lt. Ht. and Pr. Co.	Johnstown, Pa.
Menominee and Marinette Lt. and Pr. Co.	Menominee, Mich.
Bangor El. Lt. and Pr. Co.	Bangor, Pa.
Morristown Steam Heat Co.	Morristown, Pa.
Pen Yan Steam Htg. Co.	Pen Yan, N. Y.
Cedar Rapids and Ia. City Ry. and Lt. Co.	Cedar Rapids, Ia.
Newburgh Lt. Ht. and Pr. Co.	Newburgh, N. Y.
Grand Rapids Edison Co.	Grand Rapids, Mich.

—Editor.

10—20. Is it possible that a shunt exciter can be reversed in polarity when its connected load is the field of a large alternator and when the voltage is being reduced on the exciter to bring the current down to zero before opening field switch?

With conditions as stated, the field of the shunt exciter will not become reversed in polarity.

It is true that the armature has a very low resistance as compared with the shunt field, but the latter has a great many more turns than the former, and the magneto-motive force is proportional to ampere-turns and not to amperes alone; and under ordinary conditions of brush shift the demagnetizing effect is not great enough to reverse the polarity of the exciter.

I might add that I have frequently tested alternators where I had the conditions exactly as stated in the question and I have never yet seen the exciter reverse in polarity.

B. S. Gramley
Waukegan, Ill.

[The foregoing reply is seemingly in conflict with one made by W. A. Helm of Washington, D. C., in the June issue. Mr. Helm, however, merely states that "it is possible to reverse the polarity of an exciter, etc." Authorities seem to agree that while it is possible under certain conditions, it is extremely improbable, and the reply by Mr. Gramley is therefore published as supplying accurate information as to what would be likely to happen under conditions as stated.—Editor]

10—21. A 4-wire, 220-volt service was run to a 220-volt motor, as shown in diagram. The neutral was intended for a potential wire of a single-phase meter, but was accidentally connected to the motor in place of one of the phase leads, the latter being used as the potential wire for the meter. What would happen? Why?

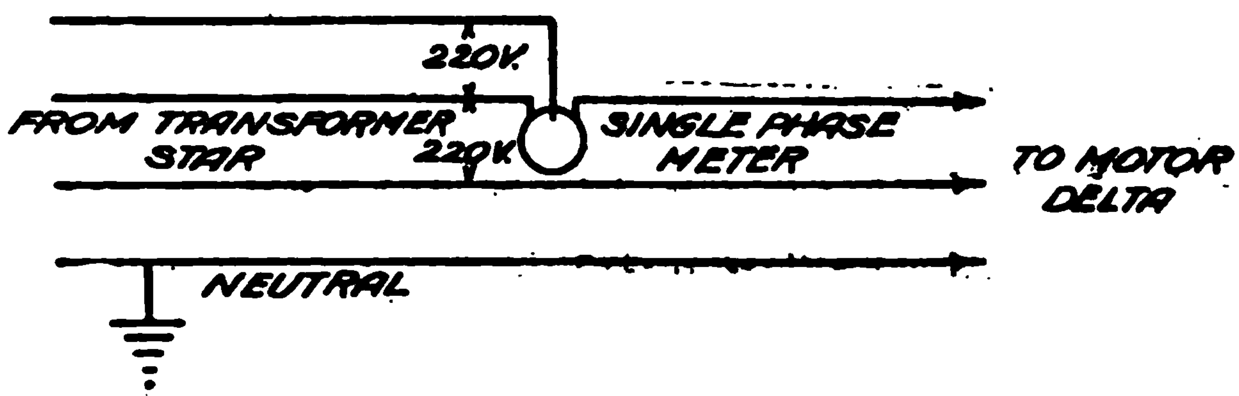


DIAGRAM (10-21)

In a four-wire, 220-volt, three-phase system, star-connected, there exists an electromotive force of 220, divided by the square root of 3, or 127 volts between the neutral and either ends of the vectors representing the stars; hence, if a neutral had been exchanged for one of the outside wires to a delta-connected motor, we would have between the neutral and either outside leg 127 volts and a phase displacement of 120 degrees, and between the outside wires we have 220 volts, or the motor would be operating on an open delta of 127 and 220 volts, respectively, which would require for the same power more current, and possibly heating would ensue. If the outside leg had been conected to the single-phase meter instead of the neutral the meter would be reading 1.73 times the true watt-hours.

C. E. Rose
Little Rock, Arkansas

The connections as shown in the diagram cause full line voltage 220 volts to be impressed on only one phase of the motor. On the other two there is the voltage from the phase leads to the neutral $\frac{220}{\sqrt{3}} = 127$ volts. This would result in a much lowered torque and break-down on small load owing to the excessive slip.

If a wound rotor there would be heavy vibration due to the unbalance of load in its windings. The phase relations would be exchanged in the *line.*

If the meter is calibrated to read correctly with the potential *taken between the neutral and one* phase lead it will over record

$\sqrt{3} = 1.73$ times when connected as shown, with the probability of a burn-out in the potential coil.

N. S. Rounds
Everett, Mass.

10—27. How does a variable-speed, three-phase, 550-volt, 25-cycle induction motor compare in price and reliability with a variable-speed, 500-volt, direct-current motor of equal horse-power output?

A 500-volt, alternating-current, variable speed motor has about the same efficiency as a shunt or compound motor with armature resistance control, and the characteristics regarding torque are approximately the same. The alternating-current motor is higher in price and reliability.

C. A. Graves
Brooklyn, N. Y.

For variable speed-work, and considering the motor alone, the direct-current outfit has somewhat the advantage. It is only about two-thirds the price, the starting torque is greater and the speed control more reliable and simple. The only disadvantage is in commutation. Conditions of distribution, however, may throw the decision the other way.

A. G. Rakestraw
Wilkinsburg, Pa.

10—27. How does a variable-speed, three-phase, 550-volt, 25-chronous motors in central stations. Is there any economy in raising the power-factor of loaded machines at the central-station end? If not, what is the purpose of the idle machine?

In some cases, by running a generator as a motor and improving the power factor of the other generators, you are enabled to overload them to a greater per cent and thereby carry your load on a certain number of machines, where without the motor you would have to run an extra turbine. If the efficiency of the generator is 94 per cent and the turbine 85 per cent at full load of 3000 kilowatts, you would make a saving of 9 per cent of the capacity of one unit or 270 kilowatts. Running 24 hours a day under those conditions you would save $64.80, if you received 1 cent per kilowatt hour. These figures are based on water turbines running parallel with a steam plant, and where you haven't enough water the turbine should be disconnected from the generator.

Oscar W. Esmond
Corinth, N. Y.

There is some economy in raising the power factor of loaded machines, as the regulation of the machine depends on the power factor of the load.

There is some gain, but whether the gain is great enough to overcome disadvantages is questionable.

The idle machine is kept running on the system sometimes to be ready for emergency in case of additional load.

George S. Hendrickson
Brooklyn, N. Y.

Except in rare cases it would be unwise to operate generators at the station as synchronous motors in order to improve the power-factor of the other generators.

Generators are somtimes operated as synchronous motors to have them on the system so as to save the time required for starting and synchronizing in case of a sudden increase in load. In this case just enough steam is turned on the turbine to keep it warm.

R. M. Stevenson
Brooklyn, N. Y.

10—31. Two groups of feeders are supplied by a generating station, one having an induction motor and lighting load, the other having a synchronous motor load. Would there not be a point where the increased line losses, due to running the synchronous motors over-excited, would more than offset the saving in generating capacity?

Yes; but the question is too indefinite to answer intelligently. It depends on the size and location of the synchronous motors. The best place for them would be on the ends of the feeders with induction motor loads so they would improve the power-factor of the line as well as the generator. Little would be gained by running over-excited synchronous motors on other feeders, as they would increase the line losses without helping anything but the generator.

R. M. Stevenson
Brooklyn, N. Y.

10—32. A six-story rotary converter is connected through a regulator to a transformer whose secondary voltage is 186. The direct-current side of the rotary is connected across the outer wires of a three-wire system, the neutral being connected to the secondary of the transformer. The rotary feeds into a direct-current system which is supplied with energy from several similar rotaries. On several occasions when the rotary has been running at light load (ten per cent of full load) it has suddenly dropped its load, and often after a short interval has suddenly picked it up again. Why does this happen? We have tried boosting the voltage on the alternating-current side when the rotary drops its load, and find that when the input to the rotary is about 50 per cent of full-load current the machine suddenly picks up the load.

Had the relative position of the regulator rotor, with regards to the neutral point at the time of sudden increase and decrease of load been stated, diagnosis of the trouble might have been simplified, but it is apparently due to mechanical defects in the regulator or regulator-operating mechanism, and I would suggest that the querist watch the action of the regulator at the time of sudden picking up of load

a battery of this type, i. e., of lead sulphuric-acid elements, to be non-sulphating, since in the very nature of its working lead sulphate results in the discharge.

In fact, lead sulphate is bound to form so long as the lead and acid are in contact. Any chemical addition with a view of reducing sulphate during the inactive periods of the battery is not likely to prevent this materially and at the same time will reduce capacity and efficiency if not also plate life.

William Yeager
Brooklyn, N. Y.

15—82. What tests, if any, are made on the oil before it is placed in the transformer? Give details of test.

A small piece of metallic sodium of potassium thrown in the oil will either flame or smoke if there is moisture present. The above elements have a strong affinity for oxygen and combine with the oxygen in the water, forming potassium oxide or sodium oxide.

Arthur S. Mullergren
Poteau, Okla.

15—85. Do the larger companies employ a process of purifying old transformer oil? Does this process necessitate expensive machinery? Give details of process.

Several of the larger companies purify fouled and wet transformer oil. Expensive machinery is not necessary. Drying may be accomplished in two ways—by blowing air through the oil and by the use of a dehydrating chemical in the oil. Both methods have been found successful in connection with a filter for the removal of solid material.

The following apparatus and process of handling has given satisfactory results:

The renovator consists of a double walled iron tank of about 65 gallons capacity; a heater, made up of 12 D :62 Ward Leonard resistance units, connected in parallel on 220 volts direct-current and mounted on a wooden frame, the frame resting on the bottom of the tank; an air pipe with 1-32-inch holes spaced about 3 inches apart attached to the bottom of the frame and connected to a Garden City No. 00 positive blower, driven by a 1/4 horse-power motor; two rotary pumps, one to pump the oil into the tank and one to force it through the filter, both pumps driven by one motor; and a No. 1 filter of the International Filter Company.

Wet and fouled oil, sent from stations and substations in 50 gallon iron tanks is pumped into the renovating tank, and heated to 90 degrees centigrade at the rate of about 2 degrees per minute. The air is started blowing through the oil when the heating is started in order to aid circulation and prevent local over-heating. After attaining a temperature of 90 degrees centigrade the heat is cut off and the blowing continued for 30 to 40 minutes. The oil is then, while hot, pumped through the filter into the tank in which it was received, this tank

having been washed out with gasoline during the interval. The ends of the tank are then painted and stenciled and samples taken for dielectric test. If the oil passes the test the tank is sealed and sent to the storeroom.

The process can be accelerated by passing the air through lime before blowing through the oil.

The second method is simple and avoids the somewhat questionable practice of heating the oil. In this process the oil is passed either by gravity pressure or by means of a pump through a bed of dry quicklime and then through a filter into the receiving tank. The flow of oil must be so regulated as to allow a sufficient period of contact between oil and lime to accomplish the drying.

E. O. Schweitzer
Chicago, Ill.

15—37. Is there any simple, reliable chemical process for removing moisture from transformer oil? Give details and experience with method, and the dependability of the process for small companies.

Drying by means of quick-lime as given in reply to 15-35. No process is dependable unless checked by dielectric tests on samples of the renovated oil.

E. O. Schweitzer
Chicago, Ill.

15—40. Kindly give a diagram of the coil connections of the General Electric I R T and I R H induction regulator primaries (rotors) used with 500-kw, 250-volt, six-phase rotary converters.

All of this particular type of regulators are special; and further, in the six-phase type, it depends on whether the transformer connections are diametric or double-delta. If the regulator is of General Electric make diagram of connections, etc., can be obtained by giving the rating and serial number of the particular machine in question.

F. W. Schackelford
Schenectady, N. Y.

15—44. Two similar three-phase transformers delta-connected operate in parallel on balanced load. One leg of one of the deltas is open-circuited. How will the distribution of the load be affected?

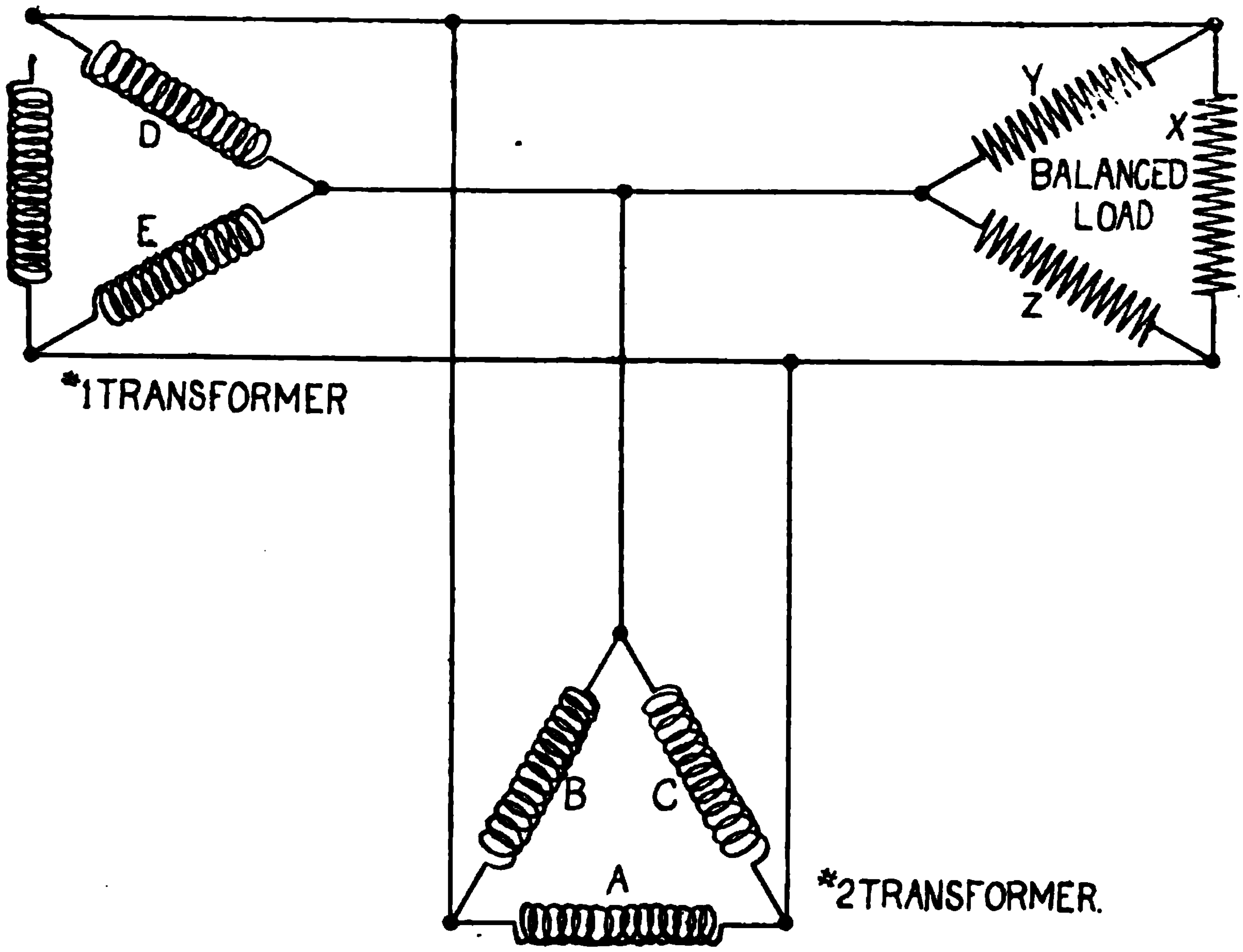
a, b, c, d, and e represent currents in respective coils of transformers.

X, Y, Z represent currents in respective phases of load.

When transformer coil open circuits, as shown, disturbing local currents will flow in windings, and these currents will have to be neglected. They will probably not affect the results materially.

Current in coil "a" will be 75 per cent of current "X" and will be in phase with it. Currents "b" and "d" will be 10 degrees ahead of "Y" in phase and will each be 57 per cent of value of "Y". Currents "c" and "e" will be 10 degrees behind "Z" in phase and be each 57 per cent of its value.

"X", "Y", and "Z" are all equal according to wording of question. If the load is non-inductive, the electromotive forces E_X; E_Y; E_Z; will be in phase with "X", "Y", and "Z" and the phase of currents in



transformer coils will vary with electromotive forces same as with currents, as previously stated.

L. R. Waugh
Brooklyn, N. Y.

16—21. With companies giving free lamp renewals, what percentage of lamps returned by customers are found to be of their rated candle-power? Are these lamps returned to service? What is the method of determining their candle-power?

Our method of determining candle-power is a visual test adopted on recommendation of Mr. Howell of the Testing Laboratories. Five lamps of different drops in candle-power are placed before the tester and he compares and classifies accordingly. All lamps of 14 candle-power or above are returned to service. Formerly a great many lamps returned by customers were found thus fit for service. Since our adoption of the Gem lamp the percentage is so small as to be negligible. The Gem lamps come back either entirely burned out or very nearly so; in fact we have to supply new lamps to our own stations. Formerly they never saw a new lamp.

H. F. Frasse
Brooklyn, N. Y.

16—22. There are a number of arc lamps on the market to-day said to be operated successfully on 25-cycle current. Have any members had experience with any of these 25-cycle arc lamps?

We have about 50 multiple enclosed arc lamps operating on a 25-cycle, 110-volt system. These lamps are of General Electric make and are installed in railroad roundhouses, where they replaced lamps operating on a 60-cycle system. They have been in use about 6 months and have proven very satisfactory. They are suspended 15 feet from the floor. We also have several flaming arc lamps in an amusement park that are operating on 25-cycles with entire satisfaction.

Roscoe McMillan
Buffalo, N. Y.

We have a number of 25-cycle flaming arc lamps in Toronto which give a perfectly steady light and have no more tendency to flicker than a 60-cycle lamp. These are flaming arcs however. There are a number of makes of 25-cycle enclosed arcs on the market, but our experience has been that, while perfectly practicable from an electrical and mechanical point of view, the enclosed arc is unsatisfactory in operation, because the variations in current strength are very noticeable in the light emitted from the arc, and this light vibration seemingly cannot be overcome.

Eugene Creed
Toronto, Ontario

16—25. We would like to hear from member companies using 25-cycle energy for lighting. Is 115-volt, 25-cycle distribution satisfactory (a) for carbon lamps (b) for tungsten lamps?

This company has about 2800 customers using 25-cycle current for lighting, and we have practically no complaints on account of the frequency of the current. The flicker due to low frequency is barely discernible, and experiments have shown that men working under electric light cannot tell the difference when the frequency of the supply has been changed. The carbon lamps and tungsten lamps seem to work equally well.

Roscoe McMillan
Buffalo, N. Y.

16—26. In places where 25-cycle current only is available for lighting and where it is necessary that direct current be used for the projection arc lamp, if the mercury arc rectifier has ever been used to make this change, with what success has it met?

We have 25-cycle only, and use same for projection arc lamps in two motion picture shows here with good results. The flicker is noticeable but not objectionable by any means. It is of course, not quite so steady as 60-cycle or direct-current.

A. G. Gibbony
Massena, N. Y.

We have one customer who uses the mercury arc rectifier on 25-cycle circuit to supply direct-current for a mercury vapor lamp. It seems to give entire satisfaction but has been in use for a comparatively short time. We have no projection arc lamps on our system.

Roscoe McMillan
Buffalo, N. Y.

16—27. What is the candle-power of a 55-volt, 32-candle-power series carbon street lamp when operated at 62 volts?

With the lamps rated at an efficiency of 3.5 w. p. c. they would give about 36 candle-power at 62 volts. A 32-candle power lamp at 55 volts consumes approximately 2 amperes, and 62 volts times 2 amperes equals 124 watts; dividing by 3.5 w. p. c. equals 35.5 candle-power.

Arthur S. Mullergren
Poteau, Okla.

16—28. Is it as good practise to hang arc lamps with metal chains as it is with cords containing automatic safety devices? We use a chain with a strain insulator, which works very well, but is possibly open to the objection that the metal is a conductor which makes an added liability. However, as our lamps have heavy insulation over the hood, it would seem as if there were very little chance of danger.

It is not good practise nor safe to hang high-tension arc lamps from metal chains unless the mast-arms or span-wires are carefully grounded at each lamp-pole. This company operates its arc circuits at approximately 6000 volts, and 6.6 amperes direct-current, and had a great deal of trouble in obtaining an insulator for suspending the arc lamp from a well-grounded support that would withstand this condition. However, we succeeded, and our standard construction is to thoroughly ground each mast-arm; also to cut in strain insulator on the chain just above reaching distance from the ground. We have had no accidents since adopting this method, and our circuit troubles have not increased to a noticeable extent.

O. H. Hutchings
Dayton, Ohio.

We have over 830 municipal arcs on mast-arms, both on wooden poles and iron poles. We use steel cable with wooden circuit-breaker cut in. We use cleat on poles and in most cases tie in with a piece of rope or loose link on circuit-breaker. Our trimmer carries rope and hook to move lamp up and down. We experience no trouble.

Daniel B. McBride
Salt Lake City, Utah.

All our lamps, which are luminous series arcs, are suspended by Oneida chain with small globe strain insulator, and in the three and a half years since their installation never has a workman got even a shock.

A. G. Gibbony
Massena, N. Y.

17—15. Have any of our member companies had experience in photometering colored lights, for instance, red, blue, green, yellow? Does the experience suggest any uniform method of comparison between such types of illuminants?

As a practical matter of central-station operation, it is difficult to see where the need of photometry of red, blue and green lights arises. If there is such a need, it would seem that the problem is so complicated that it should not be attempted unless an engineer of wide photometric experience is prepared to specialize on the subject. Certainly, there is no standardized method of conducting such photometric tests.

Preston S. Millar
Electrical Testing Laboratories

17—20. Which is the correct designation for intensity of illumination—"foot candles" or "candle feet"?

The approved designation of illumination in American practise is foot-candles.

Preston S. Millar
Electrical Testing Laboratories

17—21. We have in an office a row of double tables with clerks facing each other. The tables are spaced 10 feet 6 inches apart. It is proposed to light this office with tungsten lamps and holophane intensive reflectors hung 10 feet 6 inches above the floor level. Would it be preferable to place each lamp directly over the middle of a table or midway between the tables?

Place lamps over the middle of the table. Light distribution would be better and shadows would be avoided.

B. H. Gardner
Dayton, Ohio.

17—23. We wish to illuminate several lanes sixteen feet wide between two rows of high buildings. It is impossible to set poles more than two feet out from the building line. Fire escapes frequently extend more than four feet from the front of the buildings, and render about half of the cross-arm on the poles useless. Double pole construction with racks across the lane is forbidden. Kindly suggest a means of illumination.

As far as I know we have not had this problem, but I would suggest running guy wires from building to building and hanging a high-efficiency unit at the middle of each, with a pulley, so that it can be lowered same as an arc lamp. If permitted, the feeders could be bracketed to the buildings themselves. The parties who want the illumination should not object to any fixture necessary to accomplish the object.

A. G. Rakestraw
Wilkinsburg, Pa.

Either use underground construction and brackets, or place overhead wires and lamps on iron brackets bolted to the buildings with expansion bolts.

William Rawson Collier
Atlanta, Ga.

I would stagger the poles from one side of the lane to the other to clear fire escapes, using good stiff 30-foot poles set in concrete to avoid pulling over, and use 60-candle-power series tungsten lamps on three-foot brackets.

George W. Jones
Dayton, Ohio.

17—24. Will some member kindly make a suggestion for an electric sign to be placed on the facade of the central-station company's office building, which is four stories high, with a six-foot over sidewalk restriction?

It would seem better to use a roof sign. This company's sign on the roof of its centrally located five-story office building consists of scroll-work border, the name "The Gas and Electric Company" at the top, and three attraction lines. Matter is changed weekly. This makes a good live sign and demands attention from the public, who constantly look up to see what is new in electricity. The circulation of such advertising is only limited by the number of passers-by.

J. A. Sutton
Baltimore, Md.

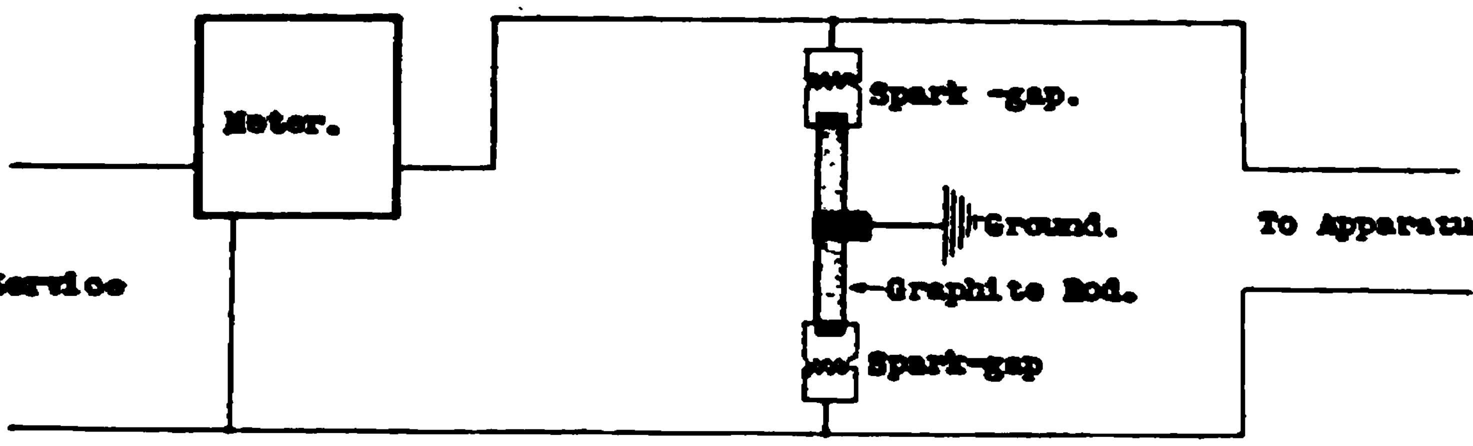
Suggesting a sign for a central-station company's office building without seeing the building is like choosing a wife for a man you don't know. If for a permanent sign it should if possible be designed to harmonize with the architectural features of the building. Then again the type of sign depends upon the length of name of the company. Would suggest sending a photo of the building to three or four big sign firms who will be glad to submit sketches. Some form of outlining is especially suitable for this purpose, but care should be taken not to overdo it either by using too high candle-power lamps or too many of them.

Parker H. Kemble
Brooklyn, N. Y.

20—45. What experience have member companies had with the metering of energy supplied to wireless telegraph stations? How has the meter been protected from burn-outs due to high potential discharges? Give the type of meter employed and any sketches or information concerning special methods of connections, methods of protections, et cetera.

A simple and effective method for protecting meters from the "kick-back" of wireless apparatus is to connect in graphite rod and

spark-gaps as shown. The rod must be of sufficient resistance to prevent the holding of an arc. The gaps must be set as close as possible without danger of contact.



R. M. Stevenson
Brooklyn, N. Y.

20—54. Does any member company use a portable artificial load for testing large capacity (25 amperes and over) single-phase meters on low power-factors? If so, please describe.

The writer knows of no artificial load that could be used in testing single-phase meters on low power-factors. The most satisfactory method at the present time would be to use customer's load whenever possible.

William Eichert
Brooklyn, N. Y.

20—65. Given a three-wire, three-phase generator, the energy from which is measured by a polyphase induction recording wattmeter properly connected to current and potential transformers; if the direction of rotation of the generator is reversed (and hence the phase rotation of power) will the direction of the rotation of the meter be changed?

The conditions given are the same that would be encountered in transposing the phase leads on any three-phase metered service. The poly-phase induction meter is a combination of two two-phase motors connected in open delta; the direction and value of the torque of each depending upon the phase displacement (lag of the current). The only change in the meter would be the reversal of the elements, as regards direction and value of torque; that is, on less than unity power-factor, the element which formerly had a stronger forward torque would now produce a backward or weaker torque, and the other element which had a weaker or backward torque would now be producing the stronger forward torque. Thus the resultant torque upon the shaft of the meter would be the same as in the start.

John K. Himes
Dayton, Ohio

20—66. In a three-phase power measurement by the two-wattmeter method, one of the wattmeters was found to read backwards whichever way the leads connected to the current terminals were

applied. The instruments were all right; what was the matter with the connections?

You will probably find that the power-factors of the different phases are entirely different, one phase probably being below 70 per cent.

William Rawson Collier
Atlanta, Ga.

If the prevailing power-factor be below 50 per cent, one meter will run in forward, and the other in a backward direction provided the proper connections are made. Both meters may be made to rotate in the same direction by reversing the current terminals in the meter which previously ran backwards, but will not register the true amount of energy consumed. To be connected properly one phase should go through each meter, with potential taps taken from the neutral or third phase and taking the algebraic sum of the two meters will give you the true amount of energy used.

R. Herkins
Dayton, Ohio

20—67. What method do member companies find to be most satisfactory of placing a permanent distinguishing mark on their meters in cities where meters of several competitive companies are installed?

We use the Westinghouse glass front meter, and attach a name-plate with our own number to the meter inside of the glass front, so that it can be read from the outside.

A. G. Rakestraw
Wilkinsburg, Pa.

We distinguish our meters by means of oval-shaped brass badges bearing the company's name. These badges are riveted on the covers of the meters and are numbered consecutively, one with the letters A. C. preceding the number, denoting alternating-current meters, and the other bearing the number alone, denoting direct-current meters.

R. Herkins
Dayton, Ohio

This company marks the number on front with a good quality of bronze powder mixed with proper liquid.

H. F. Frasse
Brooklyn, N. Y.

21—10. **In negotiating for village arc-lamp service, what is the most effective line of attack to show up the true cost of lighting to a village where the municipal accountants ignore interest and depreciation on their investment and, moreover, have their accounts in a vague condition with respect to engineering details?**

There are none so blind as those who will not see. In some cases, no doubt, the municipal authorities through self-interest are not open to conviction. Moreover, they are not inclined to accept the offers of

the central station, made in good faith, to show them the truth of the matter. Possibly the best argument to bring to bear on them would be to compile a select lot of clippings, giving the history of municipal plants that had failed through extravagance, mismanagement, etc., and present it to their attention, as well as to the attention of some of the taxpayers. If the authorities really want to know the truth, and are still suspicious of the company's figures, it might be well to introduce some impartial expert testimony.

A. G. Rakestraw
Wilkinsburg, Pa.

Submit to the council a business-like engineering report, and follow it up along the line that the lighting problem must be handled just as any other business problem is handled.

William Rawson Collier
Atlanta, Ga.

[If the village has a newspaper, get a good live story printed therein. That might help. Truth is mighty, but it's "up to you" to inform the public as to what constitutes truth.—Editor.]

21—12. What are the best arguments, giving figures, et cetera, that can be used to convince a prospective customer of the desirability of installing a motor drive in preference to a small gas engine consuming city gas at $1.00 per thousand cubic feet? Give relative cost of electricity and gas, and also maintenance charges in each instance.

When a man buys a gas engine he does so realizing that he is not getting the best power but believing that he is getting the cheapest power. He would be willing to give a little more money per month for operating an electric motor but is afraid it would cost him a great deal more. Where the rate for electricity is four and one-half cents per kilowatt-hour or less, against city gas at one dollar per thousand, an argument is hardly necessary. Under these conditions there is no logical reason why the prospective customer should not sign your contract. The only excuse a man should have for not installing a motor under these conditions is that he cannot afford to purchase the motor, in which case the lighting company should find a market for his engine where he can realize enough money on it to purchase either a new or second-hand motor.

Where the price of electricity is in excess of four and one-half cents, it is necessary to convince the prospective customer that the value of floor space taken up by the engine, repairs, loss of time through break-downs, time taken for starting and stopping engine, oil and waste, damaging effects to building and increased insurance rate are costing him more than the difference in price between electricity and gas.

The maintenance cost on gas engines depend upon the make of engine, the steadiness of the load operated and the care that is given them. For this reason there are not any standard figures that could

be used to apply to all cases. The maintenance on motors for direct-current is at least fifty per cent less than on gas engines, and on alternating-current motors it is reduced to a minimum.

A rate has been established by this company for power business which averages under four and one-half cents per kilowatt-hour. During five months' time we have displaced sixty gas engines with electric motors and there have not been any new gas engines installed during that period.

C. H. Stevens
Brooklyn, N. Y.

22—16. What information can member companies give with reference to prices secured for different sizes of series tungsten lamps for street lighting and as to the length of contracts made?

I enclose schedule of The Edison Electric Illuminating Company of Boston. We supply some thirty or forty cities and towns under this schedule, the length of contract running from no contract up to 10 years. I should say there are more 10-year contracts than any other and that 5-year came next to the 10-year.

R. S. Hale
Boston, Mass.

[This schedule embodies the following rates for tungsten street lighting:

	Fixed Costs per Lamp per Year	Running Costs per Lamp Hour
40 candle-power	$10.80	1-4 cent
60 candle-power	12.00	3-10 cent
80 candle-power	14.00	4-10 cent
100 candle-power	18.00	5-10 cent

All readings of candle-power and watts are average and not individual.

A rate of 1 cent per hour per incandescent lamp is allowed for all outages in any month, provided written notice of same is received by the company on or before the fifth of the succeeding month.

When agreements are made for periods longer than one year a discount of one per cent is allowed for each year up to ten.—Editor.]

22—23. In making power contracts, what power-factor is it usual to assume so as to be fair to the company and to the consumer?

The power factor on alternating-current motors varies with the load. It ranges on different motors from 70 per cent at 1-2 load to 90 per cent on large motors at full load. It is manifestly unfair to the customer to require a load-factor higher than the standard motor manufacturer's guarantee. For small motors it is not considered best to demand any minimum power-factors, but for large motors, especially those which will be running at the time of peak-load, a power-factor of above 85 per cent should be required.

C. A. Graves
Brooklyn, N. Y.

22—28. What is the common practise in making a charge for extending a pole line to reach houses not on the main lines?

It is our practise in case an overhead extension is required to extend the line without charge where the premises are located within 100 feet of line. If the distance is over 100 feet we require a prepayment covering partial cost of the extension. This prepayment is refunded to customer in 50 per cent amounts of his monthly bills. However, if the estimated revenue for the first year exceeds or equals cost of the extension the extension will be made without additional charge. Our practise for underground extension is similar to that of overhead.

J. L. Wiltse
Brooklyn, N. Y.

22—30. Is the actual net profit per $1.00 of gross income greater or less when current is sold to residences at a flat rate of $120 per kilowatt-year of customer's controlled demand in connection with tungsten lamps at present prices or when sold at 11 cents per kilowatt-hour with uncontrolled demand and free renewals?

No fixed rule can be laid down. The solution would depend on the demand and whether or not flat-irons, etc., were used under the meter system.

B. H. Gardner
Dayton, Ohio.

23—15. (a) In extending lines, is it proper to charge the superintendent's and the foreman's salaries to "Extension" or to "Expense"? (b) What should the installation of new machinery be charged to? (c) A river is cutting away the ground on which our plant is located, and has to be held back. Should this be charged to "Improvement of Real Estate"? Should part of the superintendent's and the foreman's salaries be charged to "Real Estate" or to "Expense Account"?

(a) The salaries or wages paid to the superintendent and foreman, while employed in line extension work, is a proper charge to Plant and Property Accounts.

(b) To Plant and Property Accounts.

(c) The cost of constructing crib-work, rip-rap work, dykes, etc., for the purpose of preventing inundation, land slides, and washing away of land, is a legitimate charge to "Improvement of Real Estate." All labor, including supervision, time of foreman, etc., on work of this kind is a part of the cost of the improvement and should be capitalized.

R. D. Rubright
Brooklyn, N. Y.

24—19. What is the policy of other companies regarding extensions for residence electric consumers? How much extension per customer?

The provisions of our company's schedules on this subject, are as follows:

1. Main extensions are made when rights-of-way and conditions satisfactory to the company obtain, at the company's expense for labor and material, to a distance of not exceeding twenty feet for overhead extensions, or two feet for underground extensions (within territory occupied by the municipal house-to-house distribution duct system) for each sixteen candle-power carbon lamp equivalent of original installation. The extension is measured in every case from the end of the existing main in a direction parallel to the thoroughfare or right-of-way to a point opposite the service entrance to the customer's property. For greater distances the customer shall pay the company in advance the estimated additional cost of the extension based on the cost per foot of the entire length of extension, which payment shall be refunded in the event of any additional installations being connected to the same extension at the same rate. All extensions installed by the company shall remain the property of the company.

2. Service connections. Where street mains are available to a point in public thoroughfare opposite the customer's premises the company will make service connections at its expense subject to the following limitations: In overhead districts, not over 100 feet of overhead service connection inside the property line to the point of attachment to the customer's structure. In underground districts (in territory occupied by the municipal house-to-house distribution duct system), not over twenty-five feet length of underground service inside the property line to the service switch. The customers shall pay the cost of all additional construction required to complete the service connection in either case, together with all rentals of any ducts on the customer's property. All service connections installed by the company shall remain the company's property.

J. A. Sutton
Baltimore, Md.

In the State of New York the law requires all electric current supplying companies to extend their mains to any applicant who is within 100 feet of the company's mains. It is the policy of this company, when the applicant is over 100 feet from our lines to require a prepayment covering a portion of the expense involved in extending the mains to his premises. This amount is repaid to customer in 50 per cent amounts of monthly bills as they come due. The prepayment required is based on the cost of the extension and the revenue which is obtained for the first year. If the estimated revenue for the first year is approximately 75 per cent of the construction cost the extension is made without prepayment. We make no charge for service connections unless same involve additional expense over the regular service costs, in which case the customer is required to pay the difference.

The policy of this company is the same for either residential or commercial business and for either underground or overhead installations.

T. I. Jones
Brooklyn, N. Y.

24—20. Do central stations which sell current by meter encourage or discourage the use of low-voltage transformers and low-

voltage lighting systems for residences? In either case, what are the methods pursued to obtain the desired result? State reasons for policy followed.

I would not recommend any lower voltage than 110 volts for residence lighting. The only gain would be the ability to use the tungsten lamp in smaller sizes and more rugged filaments. When we put against this the cost of the transformer, larger wiring necessary, difficulty of getting lamps, as well as motors, and heating apparatus for the low voltage, I do not believe it will pay the customer. If I thought it would be a real benefit to the customer, I would recommend it by all means, because I have always held the positon that the customer's interests are our interests.

A. G. Rakestraw
Wilkinsburg, Pa.

The use of low-voltage transformers is not recommended for residence lighting, especially on account of the inconvenience of not being able to use standard heating and cooking appliances, vacuum cleaners, etc. They are all right for sign and decorative work, but as tungsten lamps of 20 candle-power are now fairly durable it is unwise, in my estimation, to use a low-voltage system.

A. G. Gibbony
Massena, N. Y.

24—24. Upon what basis do companies rank their solicitors in the matter of determining the value of their services, on a merit or point basis? What is the basis of paying commissions to solicitors?

We pay no commissions to our solicitors. Each man is considered individually, and the salary paid him is based upon his individual ability.

Walter Neumuller
New York City.

We do not pay our agents a commisson. Agents are paid a flat salary based and rated according to the 50-watt equivalents secured. We have in connection with the sales department a wiring company which employs solicitors who canvass for equipment contracts. They are paid on a commission basis of $1.00 per 100-watt outlet. These solicitors only take contracts for wiring and fixtures, the applications being taken by our regular solicitors.

T. L. Jones
Brooklyn, N. Y.

Our company pays no commission to solicitors, nor does it rank them on a point basis. Records are kept of the results of each man's work. Efficiency is determined largely as shown by these records.

La Rue Vredenburg
Boston, Mass.

Class "A"—Additional consumption, either gas or electric (present consumers).... 5 points

Class "B"—New contracts, gas or electric where service was not previously in use..	3	points
Class "BB"—Industrial fuel gas	7	points
Class "C"—Replacing service or equipment for old or new party, where formerly in use	1½	points
Class "D"—Present users, changed to other address	1	point

OUTLINING

Class "E"—Outlining on buildings	6	points
Class "F"—Outlining on present signs, where flat against the building	5½	points
Class "G"—Outlining present projecting signs.	5	points

The above schedule shows classification basis for agent's commission. Take, for instance, Class "A"—additional consumption. A consumer using illuminating gas is persuaded to install a range, the estimated consumption being $20 per year; figured at 5 points, the representative is entitled to 100 points for securing this business. All other classifications are figured accordingly. A record is kept of the points secured by each representative. Awards are made as follows:

Assume that for the month of December there were 60,000 points of estimated business secured and one representative secured of that amount 6,000 points—10 per cent of the total. Now assume that for January the company has an increased gross revenue of $15,000, due to natural causes, and the work done by representatives during December. It is agreed by the company that the representatives are to have 5 per cent of the company's increased gross revenue as a bonus. 5 per cent of $15,000, $750, is therefore divided among them according to their percentage of the business secured. Thus, the representative above mentioned, having secured 10 per cent of the business in December, would receive 10 per cent of the January bonus money, namely $75, which would be paid him February 5.

In addition to bonus, representatives are paid a flat salary of $60 per month. This man would therefore receive $135 for his December work.

Clare N. Stannard
Denver, Colo.

[The Commonwealth Edison Company replies to this question with four closely typewritten foolscap pages, explaining a carefully worked out system. The main feature of the Chicago method is the payment of commissions which vary in accordance with the type of business secured. No light solicitor is given credit for over 1 horsepower taken on power contracts, and no power solicitor is given credit for light.

Power business is subdivided into four classes according to industries, and the commission paid to solicitors varies from 5 cents to 20

cents per horse-power, according to the class in which the business secured falls. For instance, elevators are included in Class 1, for which a commission of 5 cents per horse-power is paid. Laundries, breweries, and refrigeration are included in Class 4, for which 20 cents per horse-power commission is paid. Lighting is subdivided in the same way into five classes, in which the commission varies from ½ cent per 50-watt equivalent for the business of churches and schools up to 1½ cents per equivalent for the business of hospitals, large hotels, day and night restaurants and the like. The extent to which this classification is carried may be judged by the fact that, in the four power and five lighting classes, 163 different kinds of business are tabulated.

An unusual feature of the Chicago system is that, in addition to receiving credit for business secured, agents are penalized (usually ¼ cent per 50-watt equivalent) for business lost in their territory.

The company fixes a limit of $500 to the amount of commission any one man shall be paid in any one year.—Editor.]

25—6. The Supreme Court of Arkansas has ruled that a public service company is not justified in refusing to render service to anyone on account of past due indebtedness, but must, upon application of such a person, make connections and render service provided the person complies with reasonable rules and regulations as to future service. Kindly give information touching on rulings made in the different States on this point.

[Some very interesting information relating to the subject matter of this question is conveyed in a number of communications addressed recently to Mr. Martin, Secretary of the Association. The theme is of sufficient general interest to justify the use of some of this space for an epitome.

In a letter from Mr. F. E. Barker, Chairman of the Massachusetts Board of Gas and Electric Light Commissioners, it is pointed out that in Massachussetts the authority to require a lighting company to supply a would-be customer, "aggrieved by the refusal or neglect of such corporation or company to supply him with gas or electricity," is vested by statute in this Board, which has power, after a hearing, to order and enforce a company to supply an applicant with current "upon such terms and conditions as are legal and reasonable." Two sections of the Massachussetts law are quoted as follows:

"A gas or electric light company may stop gas or electricity from entering the premises of any person who neglects or refuses to pay the amount due therefor or for the use of the meter or other article hired by him from such company."

"A gas or electric light company shall not refuse to supply gas or electricity for any building or premises to a person applying therefor who is not in arrears to it for any gas or electricity previously supplied to him because a bill for gas or electricity remains unpaid by a previous occupant of such building or premises."

Mr. Barker further states:

'Our general policy is not to require a company to supply a customer against whom the company has a valid claim for gas or electricity previously supplied. Much would depend, however, upon the circumstances of any individual case. When bills are of very long standing, or the company can be secured through the taking of a deposit, and the old bill is to be paid by instalments, we would not be inclined to allow the previous indebtedness to stand in the way of supply; in other words, we endeavor to secure the would-be customer a supply through such a reasonable arrangement as a man in private business would be likely to accept."

Section 62, of the Transportation Corporations Law of the State of New York, provides that: "Upon the application, in writing, of the owner or occupant of any building or premises within one hundred feet of any main laid down by any gas light corporation, or the wires of any electric light corporation, and payment by him of all money due from him to the corporation, the corporation shall supply gas or electric light as may be required for lighting such building or premises notwithstanding there be rent or compensation in arrears for gas or electric light furnished, or for meter, wire, pipe, or fittings, furnished to a former occupant thereof, unless such owner or occupant shall have undertaken or agreed with the former occupant to pay or to exonerate him from the payment of such arrears and shall refuse or neglect to pay the same."

The Wisconsin Commission has passed very lucidly upon this question in the case of Berend vs. Wisconsin Telephone Company. The Commission rules that, "in order to properly discharge its obligation to its patrons, it is manifestly essential that the company receive promptly, at stated periods, all indebtedness due for service rendered, and that no losses be incurred, if preventable, by reason of uncollectable accounts of either the dishonest or the impecunious patron."

The Commission then presents a number of court cases, in each of which the company is held to have the right to prescribe rules and regulations "having for their purpose the enforcement of prompt payment of all indebtedness owing for services rendered by a public utility and the elimination of chances of loss caused by extending credit to those who are unwilling or unable to pay."

The commission after quoting these authorities lays down the following rules, which it says "may be deduced as reasonable regulations which may be lawfully prescribed and enforced by a public utility," to protect itself against such loss:

"1. It may require of any patron the deposit of a reasonable sum of money as security for the prompt payment of bills when due. In determining the reasonableness of the amount thus to be deposited the probable amount of the indebtedness that may be incurred within the month or other stated period at the end of which bills are made

out and rendered is an important factor. No more than a sum sufficient to furnish adequate security for the credit extended may be legally exacted.

"2. It may require satisfactory security to be furnished in lieu of such deposit.

"3. It may allow a discount upon bills paid on or before a stated day, or exact a penalty for failure to make payment within a certain time.

"4. For neglect or refusal upon the part of any patron to comply with any of the legal rules and regulations established, it may discontinue service to such patrons."

From the above rulings in several states it would seem that a common-sense interpretation of the situation presented by Question 25—6 is the one usually followed by the courts and commissions, an interpretation in line with the practise of most companies. The nub of the matter, as far as the ruling of the Supreme Court of Arkansas is concerned, turns upon the question as to what constitutes "reasonable rules and regulations as to future service." It would appear as if no court or commission would attempt to compel a public utility company to supply service to a customer from whom a past indebtedness was fairly due, unless adequate provisions were made not only for the liquidation of this indebtedness but for the protection of the company in its future dealings with the customer.—Editor.]

25—7. In what states and under what conditions has the monthly guarantee minimum charge been legally passed upon?

[In New York the courts some years ago held that the electric lighting companies in New York City were justified in making a minimum charge. Since that time, the legislature has passed a law fixing maximum rates per kilowatt-hour of current sold by these companies, and the question has arisen tentatively as to whether or not this law conflicts with the older court decision. This question has not been passed upon by the courts, but several companies continue to enforce a minimum charge per meter installed. In Mr. Martin's 1910 Report of "Committee on Progress," pages 59 and 60, the subject is brought up in connection with a ruling of the Massachussetts Commission. The Commission says in part: "While there is no legislation with respect to a charge of this character for a supply of electricity it is provided with respect to gas (Revised Laws, Ch. 58, Sec. 12) that 'no charge for the use of a meter during any portion of 12 consecutive months shall be made if the consumer during said time uses gas to the value of $7.00.' This provision seems to indicate clearly the legislative approval of a reasonable minimum charge for a public lighting company's service. It has been in force for more than 20 years with no serious demand for its revision or repeal by either the public or the companies. The reasons for permitting such a charge in the case of gas companies have even greater force in the field of electricity supply." The Commission then proceeds to fix the minimum charge at $1.00 per month per meter.—Editor.]

NEW QUESTIONS

0—19. We would be glad of information from member companies as to how they dispose of second-hand and new material that has become obsolete on their systems. Such apparatus is sometimes still in general use, and similar material is being ordered from manufacturers right along. Of course, a very tempting price could be made to such users. How can we best reach these possible purchasers?

0—20. What charges are made in cities of from 50,000 to 100,000 for inspection of wiring, fixtures, etc. Pending before our city council is a new inspection ordinance fixing what we consider very high fees, and we would like to be in a position to make comparisons.

0—21. This inquirer seeks information as to the cities wherein permits are required from city authorities before overhead or underground service may be installed and as to how long it takes to secure such permits?

12—28. Will some member company which has used concrete poles tell something as to results and costs?

12—29. Are any public service corporations using 11,000-volt overhead wires on business and residential streets?

12—30. One of our citizens owns eight lots, 25 feet frontage, comprising the whole frontage of one block, which is 200 feet long between property lines. This owner wishes to build eight houses, to be supplied with electric current (alternating) and telephones, but wants no poles or wires on the property. He thinks that an overhead-underground service might be arranged for the block by having one pole at each end of the block from which the wires could be carried down to some sort of a hollow curbstone, which would serve as a conduit and from which services, electric light and telephone, could be carried underground into the cellars of the houses. He thinks a hollow curb could be made of cement with removable iron cover. I would like to know whether or not any similar case has been worked out, and how, and would welcome suggestions.

14—4. Will member companies please give data showing relative cost of operating electric and horse-driven vehicles?

(a) What is the average kilowatt consumption of the three-ton truck?

(b) Of the ordinary runabout?

15—47. What is the power-factor of the magnetizing current of the average standard line transformer, 60 cycles, 2400 volts, of from 5 to 15 kilowatts capacity? How much has the power-factor been bettered in the past ten years?

15—48. Give diagram of connection for using two 2200-volt transformers on a three phase 2200-3800-volt system, with grounded neutral. All transformers on our three-phase system are connected star primary

and delta secondary and when one transformer is out of service on the bank three-phase motors refuse to start.

16—29. The claim is made by manufacturers that the average life of the 50-watt Gem lamp is longer by at least a third than the life of the 16-candle power carbon lamp. Will member companies please contribute information as to whether this claim is borne out by the facts? Have members data as to the actual life of the 50-watt Gem lamp in service?

16—30. What systems or methods have member companies, which supply free renewals, of guarding against theft of lamps?

18—5. Will some companies give their experience with electric washing machines. How have they been placed on the lines and do they prove satisfactory to customers after sale?

19—37. What is the maximum size (horse-power) motor accepted on single-phase circuits by member companies?

19—38. Do member companies experience trouble through installation of starting devices (used in conection with alternating-current motors) which require inordinately high starting current?

What regulations are in force by stations governing amount of current permitted in starting devices?

19—38. How large a motor do member companies permit to be installed on lighting circuits?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass. Let them come?

21—15. Is it feasible for us to furnish power to operate the local fire-alarm system from our 110-volt direct-current mains, or can it be done from a motor generator set? It takes about 80 gravity cells to keep up the system (the Gamewell) and costs $125 per year for chemicals. Besides cost of chemicals (acid, blue vitriol and lead plates) it costs $300 per year salary of man to keep battery in condition. Would like to have the experience of member companies who have operated such systems from central-station mains as to kilowatt-hours required, apparatus necessary, cost of same and all details.

24—23. Are there any companies in cities of over 100,000 which have done away with deposits, i. e., discontinued requests for deposits, and extended credit to practically all applicants? If so, what has been the results?

24—24. Upon what basis do companies rank their solicitors in the matter of determining the value of their services, on a merit or point basis? What is the basis of paying commissions to solicitors?

24—25. What natural rate of increase in gross income from current sales from year to year may fully be expected in cities of 8,000 inhabitants?

24—26. What steps do member companies take to secure and retain the good-will and co-operation of contractors? In other words, how do member companies deal with contractors so as to secure from them the highest degree of efficiency in securing business for both?

24—27. What method have member companies of securing information leading to detection of theft of current?

24—28. What is the proper amount of original cost which should be charged off for depreciation on a municipal electric lighting plant or any other electric lighting plant?

25—7. In what states and under what conditions has the monthly guarantee minimum charge been legally passed upon?

REPEATED QUESTIONS

The following recent questions have received no reply or inadequate reply. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

***0—16. What member companies sell other products in connection with electricity?**

***10—25. How does the voltage range of an interpole converter compare with that of a converter connected to an induction regulator?**

***10—28. A good many small plants are still supplying alternating current at a frequency of 133 cycles. Alternating-current apparatus when introduced appears to have been designed altogether for this frequency. What was the determining factor that caused machines of this frequency to be constructed and then superseded?**

10—34. What is the principle of and the results obtained from the use of bridges around, across, or between the pole-faces of modern synchronous machines? What are the fundamental requirements of such devices?

11—11. What kind of an instrument is recommended for locating grounds, crosses, broken wires, et cetera, on a 15-mile, 3-phase, 11,000-volt line? We had a wire down on frozen ground recently and it did not show up on the ground detector, but gave us considerable trouble to locate as it had the appearance of transformer trouble; and we, therefore, did not look for a broken wire.

11—14. What are the limiting conditions governing the opening of an arc under oil as to pressure set up in the cylinder, temperature of oil, et cetera?

***11—15. It has been noted that excessive heating sometimes arises in a metal conduit system in which the four wires of a two-**

phase system are run in one iron pipe. Is this caused by insufficient radiating surface or due to an inductive effect intensified by the metal pipe?

11—16. (a) What steps have been taken for predetermining break-downs of high-tension cables? (b) What has been done for isolating such breaks?

12—27. What experience have member companies had in the use of ordinary wood-strain insulators on dead-end 2200-volt lines?

***13—7. What is the best system for locating faults on underground cables?**

13—8. We wish to use three single lead-cased conductors placed in one duct of our underground system, instead of the regular three-conductor lead cable. (a) On a 2200-volt, 60-cycle circuit, what would be the difference in the losses and the inductive effect of these two types of cable when both are used under the same conditions? (b) On a 220-volt circuit carrying 700 amperes?

14—3. What is the relative cost per kilowatt at one-hour rating, of a storage battery and a direct-connected, 250-volt generator of equal kilowatt capacity?

***15—28. What is the practice in regard to the period of inspection of transformers in service?** (Replies requested; also see December, 1909, "Bulletin," Question 15—8; February, 1910, "Bulletin," page 264.)

***15—29. What is the general method of inspecting transformers in service?** (Replies requested; also see December, 1909, "Bulletin," Question 15—18; February, 1910, "Bulletin," page 264.)

***15—30. What electrical tests are made on transformers in service? Give details of method of test.** (Replies requested; also see December, 1909, "Bulletin," Question 15—8.)

***15—31. What tests are made on oil which has been in service, and under what conditions is the oil considered unfit for further use? Give details of test.** (Replies requested; also see December, 1909, "Bulletin," Question 15—8; February, 1910, "Bulletin," page 264.)

***15—32. What tests, if any, are made on the oil before it is placed in the transformer? Give details of test.**

***15—33. Is the oil periodically changed in the transformers irrespective of its condition? If so, how frequently is the oil changed?** (Replies requested; also see January, 1910, "Bulletin," Question 15—13; February, 1910, "Bulletin," page 264.)

***15—38. Is it general practice to test for water in a transformer by inserting a tube to the bottom of the transformer, placing a finger over the top of the tube and thus drawing out a column of the contents, showing the amount of water in the bottom of the transformer? This is based on the principle that the water being of heavier specific**

gravity will precipitate to the bottom. Does this actually occur, or will the water in the transformer oil be distributed throughout the whole body of the oil in small particles?

15—42. Given, a transformer with two separate secondary windings of different capacities and voltages, how much current will flow in each winding for any given primary current when the two secondary windings are short-circuited? Transformer capacity, 500 kilowatts. Primary volts, 11,000 (delta). Secondary winding, No. 1, 500 kilowatts at 440 volts (delta); No. 2, 200 kilowatts at 161 volts (delta).

15—45. Two similar three-phase transformers operate satisfactorily in parallel. The primaries are connected delta, and the secondaries in star. On one of these transformers two of the primary phase leads and also the corresponding secondary phase leads of the same transformer are interchanged. What will happen? Why?

15—46. The secondaries of three current transformers, whose primaries are in the three phases of a balanced three-phase circuit, are connected in series, or closed delta, in such a way that the electromotive force of one of them is in the same direction as that of the resultant of the other two. What current will flow in the secondary circuit, and what will be its phase relation?

*16—17. (a) Have any member companies tried a variety of makes of multiple tungsten lamps, from 25 to 250 watt, inclusive? (b) What make of lamp do you consider gives the best results? (Answers hereto will be considered confidential and will not be printed in the "Bulletin," but will be forwarded to the querist.—Editor.) (c) Have you noticed a deterioration in candle-power in any of the different makes? (The manufacturers claim practically no deterioration in candle-power during the life of the lamp.)

17—19. What experience have member companies had with reference to the reliability of underground series incandescent street lighting, using ornamental iron posts? Kindly furnish data and illustrations, if possible.

*17—22. Colored sources of artificial illumination modify color values considerably. Is there any table of the resulting color produced by various light-sources on original color values?

17—25. Will member companies kindly give any experience they may have had in the operation (a) of electric signs wired in series multiple, using 12-volt tungsten sign lamps and (b) operated with a five-point flasher? If companies have had no experience with these lamps and flashers an opinion would be appreciated.

17—26. Has any member company had any experience in lighting tennis courts? If so, please state method.

*19—26. With what degree of success have member companies operated five-wire two-phase secondary systems for power and lighting?

*19—31. What has been the experience of member companies in

operating the steam electric plant of a large customer to furnish power not only to the customer but to feed back current into the company's mains?

*19—35. In industrial plants where the air is heavily laden with coal dust, is a three-phase, 25-cycle locomotive preferable to a 500-volt, direct-current locomotive for yard haulage?

*20—53. (a) Are any member companies installing prepayment electric meters, and what degree of success have they had? (b) What styles of meters are being used? (c) Have any of these meters been installed for any considerable length of time?

*20—58. How is the discrepancy between station meters and the sum of the customers' meter readings distributed between the following?

(a) Distributing primary and secondary copper losses.

(b) Transformer core and other losses.

(c) Meter shunt losses.

(d) Theft.

(e) Discrepancy between flat-rate estimates and actual consumption.

(f) Unaccounted for.

Kindly give basis for data in replying.

*21—9. Kindly give information on floats used in such as Fourth of July parades and for advertising purposes.

*22—26. Has any company adopted a rule of charging customers for transformers in three-phase motor installations of fifty horsepower and above?

22—30. Is the actual net profit per $1.00 of gross income greater or less when current is sold to residences at a flat rate of $120 per kilowatt-year of customer's controlled demand in connection with tungsten lamps at present prices or when sold at 11 cents per kilowatt-hour with uncontrolled demand and free renewals?

23—16. (a) We are desirous of obtaining comparative figures from various electric lighting companies, showing the percentage that the maximum peak demand bears to the connected lighting load. Where it is possible, we should like to have the light segregated from the power load. (b) We should also like to learn of any legal rulings on this subject, and information as to how the courts have decided with respect to the percentage of a property chargeable to the lighting end of the business would be most acceptable.

*24—20. Do central stations which sell current by meter encourage or discourage the use of low-voltage transformers and low-voltage lighting systems for residences? In either case, what are the methods pursued to obtain the desired result? State reasons for policy followed.

*25—5. A citizen has brought suit to enjoin a member company from running wires through his shade trees in the allegation that this kills the trees. The citizen will not allow the company to trim the trees. Can members offer any information regarding similar suits in this country?

National Electric Light Association

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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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CONTENTS

FORMATION OF STATE SECTIONS

The issuance of the present BULLETIN has been delayed a few days in order that it might include a report of the formation of the new State Section of Georgia, at Atlanta, on October 21. The event is one of importance in the history of the Association. It follows closely the affiliation of the Nebraska Electrical Association and may itself be the precursor of similar movements in the South. It may also be taken as a further proof of the general development of the belief that affiliation of State bodies with the National society has already proven in the older Sections a distinct advantage in every way to the industry.

The National Association is fully committed to the principle of Geographic Sections, and every new affiliation brings to the counsels of its Executive Committee one more representative acquainted thoroughly with the conditions and needs of the industry in his own locality, and who thus becomes clothed with further authority. No better plan could

be devised for securing homogeneity and action that aims directly at the good of all; for while the representatives of the States are thus influential in matters that are of vital interest to central stations as a whole, each State Section remains perfectly free and independent in dealing with its own affairs and with local issues. It is indeed to be noted that under the present constitution the number of members of the Executive Committee elected at the annual convention is strictly limited and is small; but that on the other hand the President of each new State Section becomes automatically a member of the Committee; and that hence it will not take long at the present rate to place the Association itself, in this manner, virtually in the control of the State Sections. Before that tendency has fully worked itself out in practice, other processes of evolution may be set in motion shaping this federal method of work, but it is obvious that powerful forces are being thus enlisted throughout the whole country for the complete and perfect organization of the industry. Meanwhile, we are glad to welcome the Georgia Section into the Association ranks, with every hearty wish for its growth and prosperity. The Section is strong as it starts, but there is abundant material for accessions; and possibly the Section may presently embrace more than one State, like the New England Section.

OCTOBER MEETING OF THE EXECUTIVE COMMITTEE

A meeting of the Executive Committee was held on October 13 at 11 A. M. at the Association offices, New York City. The following were present: W. W. Freeman, president; W. C. L. Eglin, W. H. Blood, Jr., C. L. Edgar, John F. Gilchrist, H. A. Wagner, Dudley Farrand, A. J. Campbell, A. R. Granger, Arthur Williams, F. M. Tait and T. C. Martin, secretary.

President Freeman stated that Mr. Frueauff had accepted appointment as chairman of the Committee on Organization for the various sections and that the members of the committee would be the two vice-presidents; Mr. Alex. J. Campbell, representing the geographical sections; Mr. Joseph D. Israel, the company sections; Mr. D. B. Rushmore, the Power Transmission Section, and Mr. George Williams, the Commercial.

With regard to the Committee on Research, the president stated that this had been formed with Mr. Gilchrist as chairman and the following members: Mr. Phillip, representing Stone and Webster; Mr. Huey, representing H. M. Byllesby and Company; Mr. L. H. Conklin, J. G. White and Company; W. W. Winslow, of Superior; Mr. R. S. Hale, of Boston, and Mr. Doane, of Cleveland; thus completing the committee of seven.

Mr. Gilchrist stated that the committee had had one meeting and was planning to make investigations of the rates of all the companies represented on the committee, which would include companies of different sizes.

The secretary read the financial statement as of October 1, 1910, showing balance of $1,974.15, exclusive of $7,500 deposited in Old Colony Trust Company, $5,146.53 in Commonwealth Edison 5's and $4,983.89 in Minneapolis General Electric 5's, making a total of $19,604.57 as compared with $17,164.55 on October 1, 1909. Comparison of the September, 1910, and September, 1909, disbursements showed $1,749.93 for this year as against $1,264.63 for last, whereas the comparison of the receipts for the same months showed $1,816.85 this year and $1,254.90 for 1909.

On motion of Mr. Farrand, it was voted to pass for payment the bills for the Classification of Accounts—$647.90—and the Solicitors' Handbook—$1,524.55.

It was voted that the safe deposit box be held in the names of the president, secretary and treasurer, any two of which could have access to the box.

On motion of Mr. Campbell, seconded by Mr. Granger, it was the vote of the committee that the officers be instructed to advise the sections that in the future they would be required by the Executive Committee to present a budget of proposed expenditures and that the payment of refunds under the constitution would be made upon such submitted budgets, attaching to the budget a statement of the actual expenditures for the preceding year.

On motion it was voted that the refunds requested by the Pennsylvania and New England sections be granted, amounting to $1,000 and $500 respectively.

On motion of Mr. Eglin, it was voted that the application for refund from the Nebraska section be approved.

On motion of Mr. Eglin, it was voted that Mr. Vanderpoel's request for an appropriation not to exceed $300 for the work of the Committee on Preservation of Poles and Crossarms be approved.

The membership report showed a total of 5917 members—897 Class A, 4062 Class B, 14 Class C, 220 Class D and 724 Class E. The list of new members to be acted upon included 33 Class A, 136 B, 2 C, 3 D, 13 E. These were all duly elected.

On motion of Mr. Williams, Mr. J. E. Putnam, Rochester, N. Y., and Mr. Francis A. Vaughan, Milwaukee, were elected to Class C membership.

Correspondence with Mr. H. T. Hartman was read regarding the right of a municipality to refuse to allow an existing company to continue business, its franchise having expired. A communication on the

subject was also read from Mr. F. W. Burdett.

On motion of Mr. Eglin it was voted that the matter be referred to the Public Policy Committee.

The matter of individual badges for the members of state or company sections was discussed and, on moiton of Mr. Williams, it was voted that the geographic or other sections in adopting badges be requested to use the Association badge as a prominent part of the Section badge.

On motion of Mr. Williams, it was voted that the secretary be authorized to sell the Classification of Accounts to non-members. Mr. Williams suggested that the available publications for sale be listed in the BULLETIN.

In accordance with Mr. Eglin's request at the last meeting, Mr. Martin stated that he had secured an estimate on the publication of the Municipal and Commercial Rates, 1000 copies of each, and found that the pamphlets would cost $600 and $2,000 respectively, exclusive of clerical and statistical work. On motion of Mr. Eglin, it was voted that the present practice be continued of gathering the statistics, not publishing them, but furnishing data to members on request.

The secretary had also secured an estimate on the printing of Dr. W. H. Tolman's special report on European insurance, accidents, compensation, etc. If the entire report were printed the cost for 1000 copies would be about $2000, but Mr. Martin thought a good portion of the tables could be cut out and the cost reduced about one-half. Mr. Williams suggested that the report be abstracted for the next Public Policy Report. On motion of Mr. Eglin it was voted that the matter and method of publicity of this report be referred to the Public Policy Committee. Mr. Williams reccommended that the secretary state in the BULLETIN that the report would be on file in this office for reference.

Mr. Eglin's report on the Doherty Medal Committee was read.

The secretary stated that the Association had received 78 replies from Mr. Bailey's circular asking member companies if they favored the establishment of a statistical department. Of these 36 would be interested in the department. Action was deferred pending fuller returns and a report from the Accounting Committee.

Mr. Freeman then spoke about the next convention meeting place, and said that he and the secretary had been looking into accommodations in New York, principally at the Hotel Astor and the Engineering Building. If the committee favored New York it would be determined which was the better building in which to hold the meetings. It was decided to leave this matter to the discretion of the president and the secretary after consultation with the Exhibition Committee.

Fall Meeting of New England Section

A very successful semi-annual meeting of the New England Section was held at the Hotel Griswold, New London, Conn., on the shores of the Sound, in beautiful weather, on September 13 and 14. The attendance was large and several excellent papers were presented. President A. J. Campbell conducted the meeting with thoroughgoing efficiency and dispatch. In addition to the items on the regular programme, addresses to the convention were made by President Freeman and Secretary Martin, and a banquet was given at the hotel on Tuesday evening, September 13. The gain in interest and attendance since the autumn meeting of a year ago was remarkable.

Davenport Day in Vermont

At Brandon, Vt., on September 28, the Vermont Electrical Association, which through the New England Section is affiliated with the National Association, held its annual meeting and devoted the exercises almost entirely to the dedication of a monument to the memory of Thomas Davenport, at the nearby hamlet of Forestdale, where that modest "village blacksmith" did his wonderful work leading to the production of an electric motor in 1834-5 the taking out of the first American patent on motors, the operation of a model electric railway with track return; the operation in 1840 of a printing press by motor, and the publication in that year of two premature electrical journals, both printed by him by electric power. Davenport also was the first to organize an American electrical stock company, and to take out in England the first American electrical patent secured there. The Vermont Historical Society co-operated in the observance, and was represented by ex-Governor Stickney.

The exercises on the afternoon of September 28 were presided over by President Parker, of the Vermont Association, and prayer was offered by the Rev. W. G. Davenport, son of the inventor. President A. J. Campbell, of the New England Section, then in an admirable speech presented the tablet and handed the deed to Governor Stickney, who spoke on behalf of the Historical Society. The memorial of bronze and Vermont granite was then unveiled from its covering of an American flag by Mrs. A. J. Campbell and Miss Frances Davenport, and an "appreciation" of the inventor and his work was read by Mr. T. C. Martin.

At the Brandon Inn, in the evening, a "Smoke Talk" was given at which, under the skilful guidance of Mr. E. D. Blackwell, of Brandon, chairman of the special Davenport committee, the most interesting exercises were continued. Speeches were made by President W. W. Freeman, ex-Governor Ormsby, of Vermont, and others, and the Rev. Mr.

Davenport gave reminiscences of his father and of the struggles he witnessed, as a youth, against neglect and poverty, at a time when the work of this pioneer inventor was neither understood nor appreciated. The following day was devoted by the Vermont Electrical Association to a jolly barbecue on beautiful Lake Dunmore.

Third Annual Meeting of the Pennsylvania Electric Association

At the Glen Summit Springs Hotel, in the mountains above Wilkes-Barre, on September 14, 15 and 16, the third annual meeting of the Pennsylvania Electric Association was held with a phenomenally large attendance, a splendid programme of papers, and amidst delightful surroundings. The weather was also most favorable. Three long morning sessions were devoted to papers and reports, and the discussions were exceedingly animated and pertinent. Addresses were made at the second session by President Freeman and Secretary Martin, who made a swift transition from the New England seashore convention to the mountains in order to be present. The amusements were varied on Wednesday evening, September 14, by some excellent motion pictures, and the next evening these were shown in the natural colors.

The new officers elected are: President, A. R. Granger, Chester; vice-president, R. S. Orr, Pittsburgh; new executive committee members: M. J. Fogarty, Erie; W. C. Anderson, Plymouth; F. M. Noecker, Renovo. The indefatigable secretary, Mr. Van Dusen Rickert, remains in office. The membership of the Association, which is growing rapidly, now numbers 464.

Delivery of the Proceedings

Within a few days of the publication of this BULLETIN the issuance of the annual *Proceedings* will begin in two handsome volumes of a total of about 2500 pages, illustrated by some 500 engravings, some of which are in color; and containing about 70 valuable papers and reports with several hundred pages of discussion. There is also a frontispiece portrait and biographical sketch of President Frueauff. The volumes contain also some hitherto unprinted matter, including the twenty-fifth anniversary address of Mr. Samuel Insull and the two addresses of Messrs. Doherty and McKee on the "conservation policy" now the subject of so much controversy.

In many instances the *Proceedings* will be forwarded in bulk to the secretaries of the respective Company Sections and delivered by them. Members are earnestly requested to forward the receipt postal cards that go with each set, as the cards enable the staff at headquarters to ascertain

whether delivery has actually been made.

Particular attention is called to the fact that the Proceedings can only be delivered to companies and individuals in good standing for **1910. Any arrears should therefore be paid up promptly and now.**

Commercial Section Formation

At the commercial session of the St. Louis Convention, Vice-President Gilchrist, in the chair, appointed a committee on the Organization of a Commercial Section composed of Messrs, George Williams, chairman, J. F. Becker, E. L. Callahan, F. H. Gale, J. R. Crouse, L. D. Gibbs, H. J. Gille, V. A. Henderson, T. I. Jones, C. W. Lee, E. W. Lloyd, H. C. Mohr, M. C. Rypinski, C. N. Stannard, Frank B. Rae, Jr., secretary.

The first meeting of this committee was held in the rooms of the Association, New York City, on October 17, at 11 A. M., the sessions continuing until evening. A plan of organization with constitution and by-laws was presented by Chairman Williams and was unanimously approved for submission to the Executive Committee. This plan provides for the formation of a Commercial Committee with chairman and secretary as officers. Each member of the Commercial Committee is in turn chairman of a sub-committee appointed to investigate and report upon a specific department of central-station commercial work. Through this plan of organization it is hoped that the Association will have each year very complete and authoritative reports of commercial progress instead of one-man papers as in the past.

The first meeting of the committee was given over largely to discussion of the plan of organization and selection of subjects to be taken up by the sub-committees. At the conclusion of the session it was determined to call a second meeting on November 10 at Pittsburg, where nominations for the various committees would be made and their work outlined in full.

Forming a Georgia Section

At Atlanta, Ga., on October 20th and 21st, steps were taken by a number of central station companies in the state resulting in the formation of a geographic section of the National Electric Light Association, due to the initiative of Mr. John S. Bleecker, who, with the assistance of Mr. W. R. Collier, has been canvassing the state actively ever since the St. Louis Convention. The meetings were held at the office of the Georgia Railway and Light Company, and after thorough discussion on the first day, committees were appointed to draw up a constitution and to nominate a ticket of officers for the proposed body. At the adjourned meeting on Friday, October

21st, both committees presented their reports. The constitution adopted follows closely the lines of that of the New England Section and places the voting power in the hands of the operating companies of the state, while recognizing all the other classes of membership now known in the National organization, which at the present time has in membership in Georgia 11 Class A members and 25 Class B members, as well as a few scattering memberships amongst representatives of the manufacturing and supply houses. The section thus starts out with a good nucleus, and it is believed that the membership can be doubled or even trebled during the coming year.

The following officers were unanimously elected: President, John S. Bleecker, Columbus; Vice-President, W. R. Collier, Atlanta; Executive Committee, J. J. Cagney, Macon; R. P. Mayo, Augusta; Burdett Loomis, Jr., Waycross; Secretary-Treasurer, H. M. Corse, Columbus. The whole meeting was characterized by enthusiasm and the conviction was frequently expressed that the Georgia Section could be made one of the largest and most influential in the National Electric Light Association; besides serving as an example to some of the other Southern States now considering affiliation.

The proceedings of the convention were most agreeably varied by entertainment on the part of the local electric people. On Thursday a luncheon was given the delegates by the manufacturing and supply concerns, under the auspices of Mr. W. M. Stearns of the General Electric Company, and on Friday luncheon was given to the whole convention at the Capital City Club by the Georgia Railway and Light Company, whose officers, President P. S. Arkwright, General Manager, G. W. Brine, and Mr. W. R. Collier were indefatigable in their attentions and courtesies. During Friday afternoon the party were also given, by the Georgia Company, an automobile trip around the city to the various plants and other points of interest.

The National Electric Light Association was represented throughout the convention by Mr. T. C. Martin, Secretary, who supplied data as to the constitution, methods and practice of the other sections already affiliated.

Conditions of the Award of the Doherty Medal

The committee, of which Mr. W. C. L. Eglin is chairman, appointed to recommend the award of the Doherty Medal has not had any meetings so far, the principal reason being that the competition is open until December 31, 1910. It would appear, however, that it is necessary for some general rules or requirements to be made known to the membership; and it is therefore suggested that all papers presented before a company

branch meeting are eligible to the competition. It is recommended, however, that each company branch make a selection of the papers that it decides to submit for this award, although announcing at the same time that any person may submit his paper direct to the committee if it should not be selected by his local section.

All papers to be submitted for this award should be in the hands of the secretary of the Association not later than January 15, 1911. As authors of all papers are known, it is not practical to give letters or numbers to the papers. The rules the committee will adopt for deciding will be drawn up later and submitted to the Executive Committee for its approval in defining the merits of the respective papers submitted.

Electricity and Children's Diet

A well-known little book on children's diet, by Mrs. Louise E. Hogan, the expert writer on the subject, has recently been brought up to date by the inclusion of electrical data and methods of cooking food, etc. It is an excellent argument for the use of electric utensils, and has been adopted by some of our member companies as useful literature for their campaigns in this direction, copies being sent to residential customers with families. This seems an excellent plan, as the book is inexpensive. Mrs. Hogan's address is P. O. Box 10, Brant Rock, Mass.

A Growing Membership

A list is given in this issue of the new membership applications acted upon at the Executive Committee meeting on October 13. The membership at the present moment is 5905 being constituted as follows:—Class A 897; Class B 4050; Class C 14; Class D 220; Class E 724. The number has actually reached 5917 during the month, but the net figure is as above, due to some changes and resignations in the Class B group prior to sending out the annual *Proceedings* to members in good standing. The gain is not less than 400 during the summer months, and present activities point to a further large growth during the winter.

NEW MEMBERS

Class A: Potlatch Lumber Company, Potlatch, Idaho; United Railway Company, Grand Rapids, Mich.; Missoula Light and Water Company, Hamilton, Mont.; Ashland Light, Mill and Power Company, Ashland, Nebr.; Auburn Mutual Light and Power Company, Auburn, Nebr.; James Bell and Sons, David City, Nebr.; Columbus Electric Light Company, Columbus, Nebr.; Electric Service Company, Wymore, Nebr.; Fairbury Light and Water Company, Fairbury, Nebr.; Fairmont Electric Light and Water Company, Fairmont, Nebr.; Fullerton Electric Light and Water Company, Fullerton, Nebr.; Geneva Electric Company, Geneva, Nebr.; Hebron Light, Power and Heating Company, Hebron, Nebr.; Holdredge Lighting Company, Holdredge, Nebr.; Lincoln Traction Company, Lincoln, Nebr.; Loup Valley Electric Company, Ord, Nebr.; McCook Electric Light Company, McCook, Nebr.; Neligh Mills, Neligh, Nebr.; Nelson Light, Power and Heating Company, Nelson, Nebr.; Norfolk

Electric Light and Power Company, Norfolk, Nebr.; S. A. Oliver, Crawford, Nebr.; West Point Electric Light and Power Company, West Point, Nebr.; York Gas and Electric Light Company, York, Nebr.; Cities Service Company, New York City; Rio de Janeiro Tramway, Light and Power Company, New York City; Suffolk Gas and Electric Company, Bay Shore, N. Y.; New Jersey Water and Light Company, Deal Beach, N. J.; Titusville Electric Light Company, Titusville, Penn.; Staunton Lighting Company, Staunton, Va.

Class B: Hartford Electric Light Company, Hartford, Conn.—R. D. Cutler.

Willimantic Gas and Electric Light Company, Willimantic, Conn.—J. F. Ahern.

Potlatch Lumber Company, Potlatch, Idaho—E. J. Barry.

North Shore Electric Company, Chicago, Ill.—Fred. H. Scheel, C. H. Sutton.

Commonwealth Edison Company, Chicago, Ill.—John A. Bickel, P. B. Brown, William Donner, William L. Gruber, Charles B. Kelly, Nandor N. Landsman, R. D. Ham, I. N. Hanson.

Edison Electric Illuminating Company, Boston, Mass.—H. W. Brown.

Lowell Electric Light Corporation, Lowell, Mass.—Royal Parkinson.

Plymouth Electric Light Company, Plymouth, Mass.—George H. Williams.

Salem Electric Lighting Company, Salem, Mass.—Ralph C. Hayward.

McComb City Electric Light and Power Company, McComb, Miss.—F. H. Mohns.

Public Service Electric Company, Newark, N. J.—Walter B. Bell, W. Stanley Bruen, Gustav A. Lebtien, Walter R. McNab, George B. Mulle, Eben F. Oliver, Alex. A. Reilley.

Edison Electric Illuminating Company, Brooklyn, N. Y.—George D. Cronan, Herman Kneisel, George Maas, W. R. Sherwood.

New York Edison Company, New York City—Harris T. Luscomb.

Rochester Railway and Light Company, Rochester, N. Y.—Wilmer E. Sage, J. D. Whittemore.

Towanda Electric Illuminating Company, Towanda, Penn.—A. E. Coolburgh.

Pawtucket Electric Company, Pawtucket, R. I.—Joseph J. Dawes.

Narragansett Electric Lighting Company, Providence, R. I.—Alfred H. Allcott, Joseph Hamblin, Richard L. Holmes, M. S. Kelley, Ralph S. Knowles, E. H. Macreading, O. E. Mitchell, William W. O'Donnell, Luther P. Perry, H. H. Skinner, E. J. Wood.

Woonsocket Electric Machine and Power Company, Woonsocket, R. I.—Warren Haskell, H. M. Parsons.

San Antonio Gas and Electric Company, San Antonio, Texas—G. Wallace Smith.

Wenatchee Electric Company, Wenatchee, Wash.—Edward M. Eliot.

Toronto Electric Light Company, Toronto, Ont.—Hermann Akhurst, F. O. Bath, D. Roy Blaicher, John Blake, Ben H. Bramble, J. H. Browes, R. Edgar Brown, Alexander Burns, Charles E. Cansfield, Norman R. Carruthers, J. Walter F. Chipman, P. C. Chrysler, A. G. Churton, William Clark, W. J. Cooper, James Hannah, W. H. Ingram, Eric H. Jones, Reginald E. Jones, Charles Love, Thomas P. Marshall, William McDonald, Thomas M. Muir, J. W. Outlaw, E. J. Rodbard, M. D. Schwegler, Gilbert Scott, Ralph S. Sheppard, Joseph Sorton, Andrew Summers, Henry E. Walls, A. Whyte,

Toronto Electric Light Company, Toronto, Ont. (Second List.)—J. G. Croncher, W. F. Dent, Hugh Gaiger, C. E. Hoffman, Fred. Jarrett, Robert A. Merritt, James Orr, A. Porter, H. Rooney, J. W. Scott, Alfred Spalding, William Waters.

Class E: Franklin Electric Manufacturing Company, Hartford, Conn.—Paul G. Detweiler.

Crocker-Wheeler Company, Boston, Mass.—J. W. Johnston.

Fort Wayne Electric Works, Fort Wayne, Ind.—C. R. Metchear.

General Electric Company, Schenectady, N. Y.—William E. Haskins, Karl A. Scharfer.

Holophone Company, Newark, Ohio—W. A. Dorey.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Penn.—Henning H. Hennington.

Class C: J. E. Putnam, Rochester, N. Y.; Francis Vaughan, Milwaukee, Wis.

NEWS OF THE SECTIONS

"GET INTO THE GAME"

A number of the items in this department, for the current issue, deal with the work of the Company Sections for the coming season. It will be seen that a good start has been made and that several interesting and useful programmes have been laid out. We shall be glad to hear from other sections, but in the meantime may refer to these as excellent examples of the educational work that the Company Sections can do. It is impossible for any man to put in even half-a-dozen evenings in this way without deriving instruction and becoming a more useful employee of the company with which he is connected. In like manner, this friendly contact with others in social intercourse, this exchange of ideas and experience, this opportunity to enlarge his outlook on the problems that confront a public utility service, must tend to make each member participating in section work a more loyal and devoted official.

We would emphasize particularly the scheme of the Philadelphia Section, which, on account of its importance, is given in full. It is not strictly original, but it may be taken as a very good example of the way in which the Company Section can be utilized to set men thinking and to develop helpful ideas to be incorporated in the company's business plan. Some men are, of course, more fertile in ideas than others, whose efficiency is not be judged by their lack of imagination. At the same time, no man in any department can fail to see in his work, or the work around him, methods and directions by and along which such operations can be improved. No suggestion need be deemed too small or too insignificant. In fact, the Philadelphia Section officers do not want revolutionary projects which would involve turning the company upside down every month; but they realize as do all practical men of affairs that in the close study of minor points lies the secret of large success. The scheme is worthy of praise and equally worthy of imitation. We trust that all new methods adopted of developing Section usefulness will be brought promptly to the attention of the BULLETIN.

Growth in and Around Chicago

The Commonwealth Edison Section, of Chicago, has taken in 152 new members during the current year up to October 10. This gives the section about 475 members in good standing. For the annual election of officers on October 20, the section has issued a broad sheet ballot carrying all the names of members, this method being very popular with the whole membership. The annual dinner will be held toward the end

of the month, when the incoming officers will be installed in their respective places.

The first meeting of the fall season was held in the rooms of the Western Society of Engineers, Monadnock Building, on September 29, at 8 P. M. Papers were read by Mr. B. E. Roffee, on "The Application of Electric Motors to Group and Individual Drives for Different Kinds of Industrial Power Purposes," and by Mr. N. A. Rollins, on "Building Construction and Alterations Exclusive of Generating Stations." Secretary Hogue writes very hopefully as to the general outlook of the section.

The North Shore Electric Company Section had a membership of 106 on October 12, showing a good net gain which would have been larger but for changes in the company's forces. The annual election takes place on October 25 and it is expected to elect officers who will take a very active interest in the welfare of the section and of its members.

At the last meeting, held September 27, there was an attendance of no less than 50 members, and a good discussion was had on a paper by the company's district engineer, Mr. H. B. Rush, on "Transmission and Distribution of Electrical Energy." This paper was excellent and is to be entered in competition for the Doherty gold medal. An excellent programe of papers is planned to occupy the whole winter season of the Section.

Prizes Offered for Helpful Ideas

Action of interest to every employee of the Philadelphia Electric Company was taken at the last meeting of the executive committee of the local Section. In order to foster independent thought, and in the hope of obtaining ideas of practical value to the company as a whole, the committee authorized the offer of monthly prizes for the three best suggestions or ideas submitted relative to the advancement or improvement of the company service.

The following conditions governing this monthly competition were decided upon:

1. That the ideas or suggestions presented may relate to any branch of the company's business—whether commercial or engineering.

2. Three prizes shall be offered—a prize of $5 for the most useful suggestion; $3 for the second, and $2 for the third.

3. A committee to judge upon the ideas submitted shall be appointed by the chairman of the section, and if in the opinion of this committee the ideas or suggestions are not worthy of a first, second or third prize, as the case may be, for any one month, such prizes shall not be awarded.

4. This competition shall be open alike to all employees of the company, whether they are or are not members of the National Electric Light Association. Should an em-

ployee of the Philadelphia Electric Company, not a member of the National Electric Light Association, submit a suggestion which, in the opinion of the Committee on the Awarding of Prizes, was of sufficient merit as to deserve a first prize, he should, instead of receiving the $5 cash prize, be awarded with membership in the Philadelphia Electric Company Section, National Electric Light Association.

5. All ideas or suggestions should be written legibly on standard note size paper (preferably typewritten), placed in a sealed envelope addressed to the "Chairman, Committee on Prize Competition," and deposited in any of the question boxes located at the various offices and stations of the company.

6. The boxes will be emptied on the first of each month, and the suggestions submitted will be passed upon by the judging committee on or before the 15th of each month, and the prizes awarded at the following regular monthly meeting of the section.

As to membership in the section, the Membership Committee of the Philadelphia Section has for its chairman Mr. George Ross Green, of Meter Report fame, who is proceeding along what are believed to be original lines. He has appointed a sub-committee of approximately 40 members, made up of individuals from each of the various small departments of the company. He has outlined a follow-up system, in which record is made of each man, as approached, and if this man does not become a member his reasons for refusing are recorded. In this way it is hoped to get an expression of opinion from the entire personnel of the company, having in view the removal of all obstacles that interfere with the whole force becoming enrolled. The executive committee has decided to offer a prize of $5 in cash for the member of this sub-committee who secures the greatest number of new members between May 15 and December 15, and between December 15 and May 15. In this way, it is thought, diligence in securing "prospects" will be developed.

The programme laid out for the season 1910-11 is indicated by the following partial list of papers to be presented: "Commercial Engineering," by John Meyer; "The Possibilities of Electricity," by J. H. Deptry; "Refrigeration," by R. L. Lloyd; "Business-Getting," by J. H. Dougherty; "Diversity Factor," by C. J. Russell; "Statistics," by B. Frank Day; "Gas Lamps and Mantles," by G. B. Regar; "Steam Generating," by George Peifer.

It will be seen that the Philadelphia Section has a great "move" on, and will score heavily this year. It is in a flourishing condition, Chairman Israel is most enthusiastic, and he has imparted his spirit and energy to officers and committees all down the line.

Starting the Season in Brooklyn

The Brooklyn Company Section held its first meeting of the season on Monday evening, October 3. This was an open social meeting to which each member was requested to invite at least one employee of the company, not a member of the Association, but eligible for membership.

The chairman, Mr. E. A. Baily, opened the meeting with an able address, in which he outlined briefly the history of the section, and the many benefits to be derived from membership. He spoke very strongly of three distinct points in view for the coming year: First—that the Doherty medal must go to Brooklyn; second—that the section must be raised to a higher plane, both in general efficiency and point of membership, and third—that the section must give loyal support to their fellow-member, Mr. Freeman, throughout his term of office as president of the national body.

Following his remarks, Mr. Baily introduced Mr. B. W. Stilwell, vice-president of the Westchester Lighting Company, who addressed the section on co-operation and good fellowship. Doctor Stilwell's remarks were largely based on the "Golden Rule," his particular point being that the most satisfactory way of achieving success is by elevating one's associates, rather than by holding them down.

The next speaker was the Hon. F. E. Crane, of the Supreme Court Bench of New York State. Justice Crane's address was an inspiration to every one who had the good fortune to hear it. He pointed out particularly that the man who pays strict attention to his present duties is issured of a successful future, while the man who is always asking, "What is there in the future for me," seldom gets to the top. The keynote of Justice Crane's address is summed up in the following: "I do not know what the future is going to be; I only know this: here I am—and this is my task; and be the result what it may, let the people think what they may, the work I have got to do is going to be honestly done."

Mr. W. W. Freeman, president of the National Electric Light Association, was the next speaker of the evening, and used as a subject of his talk, "Organization." He showed how an organization, such as the Company Section, covers a field as beneficial to its members as the larger and national organizations. He spoke of the Brooklyn Company Section as having served as an experiment station and an example for other large companies in the country to follow.

At the close of Mr. Freeman's talk, the secretary made several announcements, and Mr. R. D. Rubright, the chairman of the Committee on Meetings and Papers, outlined the work for the coming year. He announced that there would be several noted speakers, among whom might be mentioned Mr. George B. Cortelyou,

president of the Consolidated Gas Company of New York, and Mr. A. E. Steers, president of the Borough of Brooklyn.

The remainder of the evening was given over to sociability, during which time refreshments were served, and the members entertained by music and singing. The next meeting of the section will be held on November 7 and will be a business meeting.

First Aid to Injured

A year ago the Niagara, Lockport and Ontario Power Company inaugurated regular "First Aid to the Injured" lectures for its employees. These lectures are given by the local physician at four different points on the system (this being necessary in order that all the men may attend) every four months. The rules laid out by the United Gas Improvement Company are followed.

The doctor uses one of the men as a subject giving a practical demonstration of artificial respiration, bandaging of wounds, sprains, etc., and later acts as the subject himself. The men are interested in the lectures, as evidenced by their attention and questions. Although they have not yet been called upon to resort to artificial respiration for any member of the company's force, one of them happened to be nearby when a young boy was taken from the water supposedly dead from drowning, and was able to restore him to life after twenty minutes of hard work, aided entirely by the instructions he had received at the lectures.

Opening Up at Toronto

The Toronto Electric Light Company Section held its first meeting of the season on Monday, October 3. A number of new members were elected. After routine business was transacted, the president, Mr. R. G. Black, who occupied the chair, introduced the speaker of the evening, Dr. Wallace Scott, who gave an interesting and instructive address on "First Aid to the Injured." The chairman added some valuable hints drawn from his large experience with high-tension work.

The latter part of the evening was given up to a musical programme. The Toronto Section is in an active condition and is growing rapidly.

Papers on Generators and Boilers

Secretary C. E. Brenton reports an attendance of about 200 at the opening session of the Union Electric Light and Power Company Section, St. Louis, on September 30. The papers read and illustrated for the evening were, "Generators," by Mr. O. M. Ward, and "Boilers," by Mr. E. H. Tenney. The discussions were entered into enthusiastically and the questions from the "Box" were also the subject of lively interest.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at the above address.

Matter intended for publication in any particular issue must be in the hands of the Editor not later than the 28th of the preceding month.

Answers will be published as soon as received.

Since lack of time and space may make some omissions necessary, the Editor reserves the right to publish only what time and space permit, and what in his judgment is for the best interests of the Association. In general, preference will be given to questions over answers, but where it is not possible to publish answers these will be mailed to the member asking the question.

The object of the Question Box is to keep members in touch with one another's work and to do it promptly and efficiently.

Suggestions and criticisms tending to improvement are invited.

HOW MANY ARE THERE?

A fairly liberal response has been received to the plea published in the last issue for help in this "Question Box" work, but there is still room for improvement and a further opportunity to the members of the Association to show that spirit of co-operation and unselfish willingness to assist one another, which is a characteristic of our industry. Many members do not seem to realize that the questions in the "Box" are real requests by member companies for information on matters of current interest or vital concern in their affairs, and should therefore be responded to as if each question was a personal appeal.

The editor of the "Box" never knew a time when one central-station man, approached by another with a reasonable request for information which the first possessed, and the knowledge of which would be of value to the other, did not promptly and cheerfully furnish the information required. It is in this same spirit that your editor requests consideration of problems put forward from month to month in these pages.

In our editorial last month we said: "No man should be too big or no man too small to ask or answer willingly questions leading to information of advantage to the industry." This is literally true, and the big man will be the first to recognize its truth. He is, as a rule, approachable, human, helpful, willing as far as the demands upon his time will permit to respond to a call from his fellows and to give them the benefit of his knowledge and experience. We do not

hesitate for a moment to call upon him for his co-operation, and feel confident of receiving it.

The small man may some day become a big man, and the "Question Box" is one of the methods whereby he can increase his fund of information, extend and confirm his knowledge, and become known by name and reputation to his associates in the business.

The "Question Box" is for all members who know, and all members who want to know. How many are there?

As a corollary of the foregoing, extracts from two communications received by your editor a few days ago should prove of some interest. They certainly gave him encouragement and pleasure. Here is what one representative of a large company, who has done his full share of "Question Box" work, wrote:

"I want to say to you that I have derived considerable benefit from the attention that I have given the "Bulletin." I am now arranging for a series of articles for a technical paper, the editor of which had seen my name as a contributor to the "Question Box." There also are other things in prospect which are being brought about through the same agency. I suppose a good many of the members feel that it is not worth their while to devote their time to it. For the encouragement of such I want to put my testimony on the other side."

The other writer is in a position of authority in a smaller company. He says:

"The writer had entirely forgotten the old adage 'It is more blessed to give than to receive'; heretofore I have done all the receiving. Thanks to your little editorial, I will in the future try and do some giving."

And he forthwith proceeds to supply a number of interesting and valuable replies.

CLOTHES-WASHING MACHINES

The response to Question 18-5, concerning experience of member companies with washing machines, is rather interesting. No experience, otherwise than one of satisfaction with this appliance, is reported. One "Question Box" correspondent, writing an "aside" to the editor, says:

"I have a washer of my own, and I am so delighted with it that I find it hard to keep to moderate terms in discussing the matter. I would not take double what it cost me. It simply turns washday into playday. I think it will save its cost in cold cash the first year."

The impression gathered from all this is that the washing ma-

chine is an appliance that will justify further exploitation and more sales effort than it has so far received at the hands of the majority of central stations.

ANSWERS

0—18. An incandescent lamp does not flicker noticeably on 25-cycle energy at normal voltage. If, however, one of the lamp terminals is connected to one side of the 25-cycle main, and the other to one side of a direct-current system of the same voltage, the lamp flashes brightly and the flicker is very noticeable. Please explain.

While I do not wish to appear critical of small details, I still think that it is just as well to be accurate wherever possible.

In the "Question Box" for August-September, you publish an answer to Question 0-18, the author of which mentions a direct-current voltage of 110 volts; while for the alternating-current voltage, which in the question is said to be the same as the direct current, he evidently uses a voltage with a peak of 110 volts. An alternating-current voltage, however, is invariably denoted by its root mean square value and all standard alternating-current instruments read this value. It would, therefore, seem that the author's assumptions do not quite agree with the conditions denoted in the question.

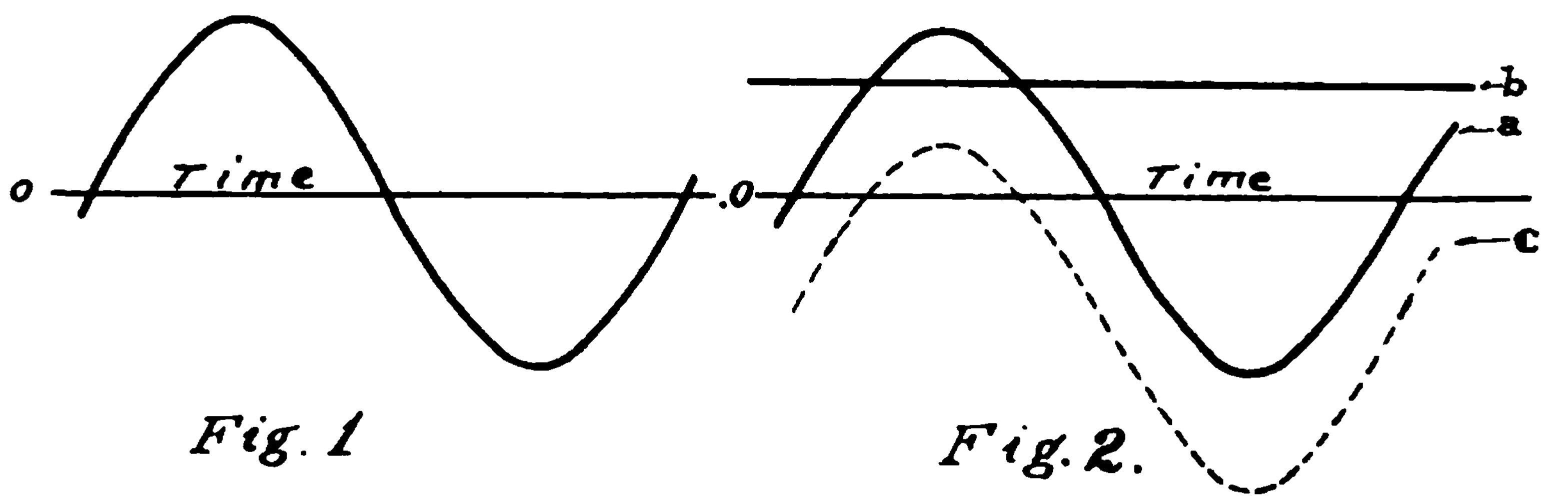


Fig. 1 Fig. 2.

Figure 1 shows the voltage wave across the lamp on a time base for the case where it is operated on the 25-cycle alternating-current circuit.

In Figure 2 the curve "a" shows the "absolute" potential of the alternating-current terminal of the lamp, while the horizontal straight line "b" represents the constant potential of the direct-current terminal.

The voltage across the lamp is the difference of potential between the two terminals. A curve representing the difference between "a" and "b," such as "c," will therefore give us the instantaneous voltage across the lamp in the case where the lamp is connected to the alternating-current and direct-current terminals simultaneously.

Compare the effects of impressing on the lamp voltages varying in accordance with the wave in Figure 1 and with the one in Figure 2.

In the first case the voltage, and consequently the candle-power, rises to successive equal peaks once every 1/50 second, but the candle-

power at no time varies markedly from the average, while in the second case the successive peaks differ to a marked degree in size. There are now two sets of equal peaks, one very small in comparison to the other, which alternate with one another. The strong contrast in candle-power between two consecutive peaks, one small and the next large, is easily appreciated by the eye and gives rise to the sensation of flicker.

It is, of course, assumed that there is some electrical connection between the free terminals of the alternating-current and direct-current circuits, otherwise the lamp would not light at all.

Tyrrell Ferrier
Cleveland, Ohio.

0—19. We would be glad of information from member companies as to how they dispose of second-hand and new material that has become obsolete on their systems. Such apparatus is sometimes still in general use, and similar material is being ordered from manufacturers right along. Of course, a very tempting price could be made to such users. How can we best reach these possible purchasers?

When this company has second-hand material to dispose of, we refer to a list of second-hand and scrap dealers, which is always kept up to date. Whenever we get in touch with a new name it is added to the list. The dealers are separated as follows:

Second-hand material
Scrap iron
" brass
" copper
" lead

We also frequently refer to McGraw's Electrical Directory of Central Stations.

George M. Valentine
Brooklyn, N. Y.

Material in question could probably be disposed of to some of the dealers in second-hand machinery and apparatus; names of these firms could be easily ascertained by looking in the advertising columns of the leading engineering magazines.

If you desire to sell the material direct, probably an advertisement in one of these magazines would place you in touch with prospective customers.
William Rawson Collier
Atlanta, Ga.

Advertise, or exchange with the manufacturer for more adaptable appliances.
T. J. Hancock
Montgomery, Alabama.

Advertise in the columns of the "Electrical World," "Electrical Review," "Central Station," "Electrical Record," "Selling Electricity,"

and other electrical journals, or read the advertising columns of these papers and see what others require. Simply try to sell them the same as you do your current.

Eugene Creed
Toronto, Canada.

We have disposed of considerable of our obsolete apparatus to small villages which are unable to finance an up-to-date plant.

T. H. Yawger
Rochester, N. Y.

This company sells their second-hand equipment through the agency of the Power Equipment Company to whom we pay a stated percentage on amount of various sales.

The Power Equipment Company advertises in nearly all trade papers as well as sending out bulletins and circular letters all over the country.

It is very hard to explain just how they sell the equipment. It is only by the regular method of hard work, correspondence and advertising.

Yours truly,

C. Marden
Chicago, Ill.

0—20. What charges are made in cities of from 50,000 to 100,000 for inspection of wiring, fixtures, etc. Pending before our city council is a new inspection ordinance fixing what we consider very high fees, and we would like to be in a position to make comparisons.

The fees charged by the City of Davenport through its city electrician are as follows:

Permits for Incandescent Wiring	
1 to 5 lamps	.50
5 " 15 "	1.00
15 " 25 "	1.50
25 " 50 "	2.50
50 " 100 "	3.75
100 " 150 "	5.00
150 " 200 "	8.00
200 " 500 "	10.00

Permits for Motors

1 horse-power or less, 50c.; excess at 50c. per horse-power.

5 horse-power, $2.50; excess at 25c. per horse-power.

10 horse-power, $3.75; excess at 10c. per horse-power.

Permits for setting poles: 1 pole, 50c.; excess, 25c.

People's Light Company
Davenport, Iowa.

City of Springfield makes no inspection, same is carried on by a National Board to a limited extent. While we feel that only first-class work should be installed, we also feel that charges as made by the National Board are rather unreasonable. In fact, we informed their representative only a few days ago that we could see no excuse for an inspection charge being made for electrical installations when all other inspections were made by the insurance people, gratis. Their reply was that old weak argument that is too ancient to repeat.

The Springfield Light, Heat and Power Company
Springfield, Ohio.

In accordance with the provisions of the Building Code of Utica, the contractor must furnish us with a temporary 30-day certificate, allowing us to connect our wires with the premises.

In order to secure this permit the contractor must first apply to the inspector, who is the representative of the Fire Underwriters' Association and pay the regular fee. The contractor is charged this amount covering the inspection, and he in turn charges it to the customer. The company in no case pays the inspection charge. The contractor delivers his temporary permit to our office, and we connect the customer with our service. If the inspector does not notify us of any defects in the wiring or fixtures, at the end of the time of the temporary permit, it is apparent that he has accepted the work.

The Utica Gas and Electric Company
Utica, N. Y.

We do not have inspection ordinances to take care of in this city, therefore have no charges to look after. I am sorry for anybody who does.

Erie County Electric Company
Erie, Pa.

In Portland, the City of Portland inspects all buildings and issues a permit of connection to the electric light companies before any current is turned on to the building. This inspection is done by the city without any charge whatsoever either to the proprietor of the building or the electric light company. The inspectors are under the supervision and charge of the city electrician.

Consolidated Electric Light Company
Portland, Me.

This city employs an electrician to make inspections of wiring in premises which we supply. He is employed on a straight salary and there are no expenses incurred by the lighting company or the consumer.

Des Moines Electric Company
Des Moines, Iowa

In this city an inspection ordinance was passed about a year ago, and although the inspection charges are high and the requirements stringent, we have not found that it interfered materially with our business.

Peoria Gas and Electric Company
Peoria, Ill.

There is no ordinance in this city requiring this company to pay any inspection charges and we never have been confronted with such a condition. The Indiana Inspection Bureau, controlled by the various insurance companies, maintains an office here, and inspects the interior wiring. A small fee is charged, which is included in the contractor's bid. Where the customer declines to have the work done in accordance with the rules of the National Board of Fire Underwriters, his insurance rate is raised accordingly by the inspection bureau. The

result is, in a large majority of cases the wiring is done as per the requirements of the inspection bureau, as in the end it is a matter of saving to the consumer.

The Evansville Gas and Electric Light Company
Evansville, Ind.

There is in existence in Camden, N. J., an inspection ordinance which carries with it a schedule of charges identical with those made by the Underwriters' Association of the Middle Department. When this ordinance was passed the Underwriters' Association agreed to waive its inspection and charges, provided the city inspector carried out the inspection to its satisfaction and issued proper permits. This understanding, however, was never consummated. The insurance people continue to make inspections and collect charges therefor, while the city ordinance at present, so far as inspections and charges are concerned, is a dead letter.

Public Service Electric Company
Trenton, N. J.

We have a city electrical inspector and are not permitted to connect buildings without the approval of said inspector, who was appointed at the solicitation of the insurance companies, and which we believe is a good thing for the lighting company. There are, however, no charges made for the inspection and we would certainly protest against any charge being made unless a similar charge was to be made by all other inspectors, such as gas and water.

Indiana and Michigan Electric Company
South Bend, Ind.

We were successful in having the following scale of prices adopted by our city council for inspection work.

$1.00	to	$150.00	$1.00
150.00	"	300.00	2.00
300.00	"	450.00	3.00
450.00	"	600.00	4.00
600.00	"	1,000.00	5.00
1,000.00	"	1,500.00	6.00
1,500.00	"	2,500.00	7.00
2,500.00	"	3,500.00	8.00
3,500.00	"	5,000.00	9.00
5,000.00	"	7,000.00	10.00
7,000.00	"	10,000.00 and over	11.00

This inspection fee covers all wiring work done in one building. Any wiring done or attachment made without having the same inspected and permit issued to the electric light company is counted as a misdemeanor and a fine of $15 is imposed for each offense. This gives us protection against stealing of current, which is not at present covered by a state law. This inspection is paid for by the consumer.

Little Rock Railway and Electric Company
Little Rock, Ark.

ELECTRICAL INSPECTION FEES
City of Montgomery, Ala.
Concealed Work to Outlets.

1 to 3 outlets	$0.50
4 to 10 outlets	1.00
11 to 15 outlets	1.50
16 to 24 outlets	2.00
25 to 50 outlets	4.00
51 to 100 outlets	6.00
101 outlets and over	10.00

Arc Lights.

1 to 3 lights	$0.50
4 to 10 lights	1.00
11 to 20 lights	2.00
21 lights and over	3.00

Fixtures

1 to 3 lights	$0.25
4 to 10 lights	.50
11 to 20 lights	1.00
21 to 40 lights	1.50
41 to 75 lights	2.50
76 to 150 lights	3.50
151 to 500 lights	5.00
501 lights and over	10.00

Open Work

Incandescent lights and fans; fixtures included

1 to 3 lights	$0.50
4 to 10 lights	1.00
11 to 20 lights	1.50
21 to 50 lights	2 25
51 to 100 lights	3.50
101 to 500 lights	5.00
501 lights and over	10.00

Motors

½ to 1 horse-power	$0.50
1½ to 3 horse-power	1.00
4 to 10 horse-power	1.50
11 horse-power and over	2.50

Isolated Plants

Charge according to schedule, and add $1.00 for dynamo.

T. J. Hancock
Montgomery, Ala.

0—21. This inquirer seeks information as to the cities wherein permits are required from city authorities before overhead or under-

ground service may be installed and as to how long it takes to secure such permits?

In Atlanta permit is issued for connection to overhead service as soon as the city electrician has inspected and approved the wiring and electric fixtures in the house under consideration. Under ordinary circumstances, approval is received within twenty-four hours after the wiring is completed and the fixtures installed.

Permission for making underground connections and for opening the street can generally be obtained in one day, if the street to be opened is not one classed as "Permanently Paved."

Streets so classed are streets which have recently been paved with asphalt or wood blocks and the law does not allow opening these streets within five years after their completion, except by special permission granted by city council. To obtain this special permit sometimes takes two weeks.

William Rawson Collier
Atlanta, Ga.

In Pittsburg we are not allowed to make a connection, either to a new building or to one which has had the current in before, without an inspection and approval by the Bureau of Electricity. This usually requires two or three days. In urgent cases we sometimes make the connection in advance of the inspection, subject to the approval of the authorities.

A. G. Rakestraw
Wilkinsburg, Pa

9—1. What member companies sell steam heat as a by-product?

[In addition to the names of companies published in the last issue of the "Question Box," the following names of companies now selling steam heat is supplied by the American District Steam Company of Lockport, N. Y.:

Consumers' Light and Power Co.	San Francisco, Cal.
Seattle Electric Co.	Seattle, Wash.
Northern Heating and Elec. Co.	St. Paul, Minn.
Quincy Gas, Elec. and Htg. Co.	Quincy, Ill.
Rockford Electric Co.	Rockford, Ill.
Indianapolis Light and Heat Co.	Indianapolis, Ind.
Citizens' Light and Power Co.	Adrian, Mich.
Lincoln Traction Co.	Lincoln, Nebr.
Geneva-Seneca Electric Co.	Geneva, N. Y.
Hornell Electric Co.	Hornell, N. Y.
Lockport Lt., Ht. and Power Co.	Lockport, N. Y.
Cleveland Electric Illum. Co.	Cleveland, O.
Oberlin Gas and Electric Co.	Oberlin, O.
Erie Company	Erie, Pa.
Eastern Pennsylvania Power Co.	Easton, Pa.
Scranton Electric Co.	Scranton, Pa.
Montreal Lt., Ht. and Pr. Co.	Montreal, Que.
Brandon Elec. Lt. Co., Ltd.	Brandon, Manitoba.

It may be of interest to the member company asking this question to know that a paper on the development and application of central-station heating was read by C. R. Bishop before the Pennsylvania Electric Association at its recent convention at Glen Summit Springs. In this paper Mr. Bishop makes the statement that, "In Pennsylvania there are a greater number of cities having district heating service than in any other state, and Pennsylvania can also claim the most extensive steam-distribution system in existence." Mr. Bishop also states that, "There is no class of service as popular with the public, no patronage which can be acquired with as little effort, none which is as sure to continue permanently as steam heating."

The paper contains interesting data and suggestions, and any company contemplating going into the business of steam heating will find it of undoubted advantage to secure a copy.—Editor.]

10—25. How does the voltage range of an interpole converter compare with that of a converter connected to an induction regulator?

The direct-current voltage of the split-pole rotary ranges from a maximum, the standard value resulting from the normal ratio of transformation in rotaries, to about 60 per cent of that amount. But it is possible to equip any rotary with a regulator that will give many times that range, though any variation greater than that permitted by the split pole would be of no practical value for most commercial purposes.

W. Uckele.
Brooklyn, N. Y.

10—28. A good many small plants are still supplying alternating current at a frequency of 133 cycles. Alternating-current apparatus when introduced appears to have been designed altogether for this frequency. What was the determining factor that caused machines of this frequency to be constructed and then superseded?

With reference to the reasons for use of frequency of 133 cycles and also the reason for superseding such frequency: I cannot answer the first question with certainty but will give you what seems to me a plausible explanation.

Inasmuch as the exact frequency of the first alternators was immaterial to successful operation, I think the establishing of 133 was purely accidental. The first alternators were small belt-driven machines. Certain types, with which I was more or less familiar, were rated 500-light machines. We must remember that the original machines were not given a kilowatt rating or horse-power rating, but were rated in number of candle-power lamps that constituted a load. Undoubtedly earlier machines were still smaller—say for 100 or 200 lights. Such machines would naturally have a speed of about 2000 revolutions per minute, or that which was common for the small incandescent direct-current machines built in the 80's. It is probable that a designer, after deciding upon a speed of 2000 revolutions per minute for a small alternator, would select eight poles, which would mean a

frequency of 133 cycles. My reason for advancing this theory is the fact that early in the 90's I was personally responsible for starting two or three odd frequencies that are still in existence in important transmission systems in this country, and the factors that decided the frequency were strictly those pertaining to the design of generator. The speed of the prime mover was given and the number of poles of generator selected with reference to most economical and efficient design.

The reasons for abandoning the frequency of 133 cycles are: first, the objections to the high periodicity in transmitting any considerable amount of power for any considerable distance; second, the fact that lower frequency, such as 60 cycles, was immensely better for motor work and the general applications of electricity.

W. J. Foster
General Electric Co., Schenectady, N. Y.

The simple single-phase alternator is satisfactory for lighting or heating but not for motive purposes because of the difficulty in designing single-phase motors which will start under load. But as the first application of electricity was for lighting, the single-phase machine of 133 cycles served the purpose.

133 cycles was chosen as a frequency because it was figured that at such frequency there would be no flickering of light. Also alternators would be cheaper at a higher frequency because of the greater capacity obtained with the higher speed, and transformers would be cheaper due to the fact that less iron is necessary for the core.

When it became necessary not only to furnish current for illumination, but power for the operation of motors, rotaries, etc., it was found that a frequency of 133 cycles meant too high a speed, or too expensive machine construction due to the many poles required to keep the speed normal. The high speed also made it impracticable to operate alternators in parallel. When the industry reached the point where it was necessary to transmit power long distances, the fact that the reactance of the line varied directly with the frequency, meant that at 133 cycles the reactance drop would be more than double that for 60 cycles, and therefore the line loss would be considerably increased.

In transformers the hysteresis loss varies directly with the frequency and the eddy current loss directly as the square of the frequency. Therefore the higher the frequency, the poorer would be the transformer regulation and the lower its efficiency.

By experiment it was found that lights could be operated satisfactorily on 60 cycles, and as this frequency is also satisfactory for the operation of motors, it was chosen as a standard lighting and power frequency. Many lighting and power companies use 25 cycles for the frequency of the high-tension transmission system, and for distribution to motors, but such companies usually use 25-60 cycle frequency-changer sets for lighting distribution. **Alden W. Welch**
Brooklyn, N. Y.

The fact that arc lamps could not be operated on a lower frequency was the determining feature at first. Later 133 cycles was found to be too high for power work, which caused the adoption of the lower frequencies of 60, 50, 40 and 25. The disadvantage of having so many different frequencies has led to the discarding of 50 cycle and 40 cycle, since they have no distinct advantage. Twenty-five and 60 cycles are now considered as standard.

J. D. Whittemore
Rochester, N. Y.

The earlier apparatus was designed for high frequency to accomplish economies in transformer design, generator construction, etc. This was satisfactory when most of the business was single-phase lighting work. The development of the induction motor has forced frequencies downward, since to get reasonable speeds, high-frequency motors would have had to be made up with a prohibitively large number of small poles and complicated wiring, resulting in very unsatisfactory characteristics.

John C. Parker
Rochester, N. Y.

10—84. What is the principle of and the results obtained from the use of bridges around, across, or between the pole-faces of modern synchronous machines? What are the fundamental requirements of such devices?

Bridges or dampers may be used for one or a combination of the following reasons:

(1) To prevent hunting.

(2) To develop starting torque as in synchronous motors or rotary converters.

(3) To eliminate the pulsations of single-phase armature reaction, as in single-phase railway generators.

(1) So-called hunting in synchronous machines is always accompanied by a shifting of the magnetic field across the pole faces, the magnetic field being alternately stronger at the leading and trailing pole tip. The introduction of a copper circuit across the pole face tends to prevent hunting by preventing the shifting of the magnetic field. A damper winding for this purpose is most effective when it is of low resistance, and with a large number of bars across the pole face. The bars near the pole tips are the most effective since the changes in magnetic field are greatest at these points. The bars between the poles when used are of very little effect since there is practically no magnetic field between the poles. When the damper is used only for the prevention of hunting, it is relatively unimportant whether the end rings connecting the bars across the pole face are joined between poles or not.

(2) When the damper winding is used for starting purposes it operates in exactly the same way as the cage winding of an induction motor secondary, and its construction follows the same form. In this

case a higher resistance winding may be used than in the first case in order to obtain a higher starting torque or to reduce the current taken from the line during starting with a given starting torque. It is important that the end rings be continuous, joining the bars of different poles in order to produce a more uniform torque.

(3) The armature reaction in a single-phase generator is pulsating instead of uniform as in polyphase generators. This pulsating armature reaction causes eddy currents in the field core which, in large generators, would cause dangerous heating. The cage winding is added to eliminate the inequalities in the armature reaction, and, therefore, the dangerous heating caused by it. The damper winding for this purpose is of very low resistance in order that the loss in the damper winding will not cause heating.

While damper windings could be of different construction for the three functions mentioned, the dampers are usually built with the same construction in order to facilitate manufacture. The damper winding similar to the cage winding of the induction motor has been very generally adopted as the most suitable design.

F. D. Newbury
Westinghouse Elec. and Mfg. Co., Pittsburg, Pa.

11—11. What kind of an instrument is recommended for locating grounds, crosses, broken wires, et cetera, on a 15-mile, 3-phase, 11,000-volt line? We had a wire down on frozen ground recently and it did not show up on the ground detector, but gave us considerable trouble to locate as it had the appearance of transformer trouble; and we, therefore, did not look for a broken wire.

There is no instrument particularly designed for this purpose that we know of. The course which is ordinarily pursued to locate trouble of the character suggested, would be to apply an insulation test to the three conductors on the system to determine whether the lines were free and clear from grounds. If the line in question supplied a substation a test would be made by testing each wire individually between the generator and the substation. If either of these tests indicated trouble with the line, an inspection of the line would be made before attempting to resume service.

L. L. Elden
Boston, Mass.

We have a 35-mile, 33,000-volt transmission line. We patrol it regularly, and at other times when any irregularity shows up.

T. J. Hancock
Montgomery, Ala.

Our experience has shown that each conductor of a transmission line should be equipped with a ground detector. When a ground develops the conductor on which the ground exists will be indicated.

On a transmission line with wooden poles, cross-arms and pins, when trouble is due to defective insulators, the ground will probably not become of sufficiently low resistance to permit the application of a Murray loop test to locate the point of trouble. In such case prob-

ably the best plan is to keep potential on the line from a separate generator and a patrol will then locate the trouble where the pin and cross-arm will be found on fire.

On a line where steel poles, cross-arms and pins are used a ground is usually of very low resistance. If power can be taken off the line before the conductor is burned off, the point of trouble can be accurately located by a Murray loop test. We have a home-made testing outfit arranged for use of 125-volts direct-current which works very satisfactorily for this purpose.

If conductors become crossed or remain in contact for any length of time they usually burn off. Such open circuits can best be determined by reference to the ammeter with which each conductor should be provided.

It should be easy to distinguish between trouble on the line and trouble in transformers by applying potential to them while connected, and afterward applying potential to one of them while the other is disconnected. L. E. Imlay, Superintendent

The Niagara Falls Power Co.

Niagara Falls, N. Y.

11—15. It has been noted that excessive heating sometimes arises in a metal conduit system in which the four wires of a two-phase system are run in one iron pipe. Is this caused by insufficient radiating surface or due to an inductive effect intensified by the metal pipe?

A loose connection of one phase may cause an overflow of current on the other, or small wires overloaded. We have a large amount of this construction, and heating has been traced solely to one phase being out. **T. J. Hancock**

Montgomery, Ala.

12—27. What experience have member companies had in the use of ordinary wood-strain insulators on dead-end 2200-volt lines?

Wood-strain insulators have proven very satisfactory.

T. J. Hancock

Montgomery, Ala.

12—30. One of our citizens owns eight lots, 25 feet frontage, comprising the whole frontage of one block, which is 200 feet long between property lines. This owner wishes to build eight houses, to be supplied with electric current (alternating) and telephones, but wants no poles or wires on the property. He thinks that an overhead-underground service might be arranged for the block by having one pole at each end of the block from which the wires could be carried down to some sort of a hollow curbstone, which would serve as a conduit and from which services, electric light and telephone, could be carried underground into the cellars of the houses. He thinks a hollow curb could be made of cement with removable iron cover. I

would like to know whether or not any similar case has been worked out, and how, and would welcome suggestions.

I believe that the sidewalk conduit would be preferable to a hollow curb on account of the cost of building the hollow curb, and on account of the fact that it might be easily broken by heavy wagons backing into it. In laying the sidewalk conduit, fibre duct, sheraduct or vitrefied conduit should be used; this being placed about a foot under the sidewalk and about one foot inside of the curbing.

In front of each residence the conduit should be run into a small iron junction box where taps could be made for the residence.

The cost of such a system as this is comparatively small and our experience shows that it is entirely satisfactory.

William Rawson Collier
Atlanta, Ga.

Set poles in rear of buildings, or run service from one cellar to another, attaching the service at each building. A ship-shape plan would be to place a switchboard in the cellar of one of the middle houses, having meter loops, etc., with separate lines to each flat.

T. J. Hancock
Montgomery, Ala.

Six residences here occupy an entire block, and for their electric light and telephone service they have installed underground conduit system of tiling leading to the basements. In this instance, individual services were used, leading from the basements direct to the end of the alley, coming up from the tiling through iron conduit up the side of pole within three feet of the cross arms. The telephone connections are made at the other end of the alley. This system could no doubt be greatly improved upon; however, it has given excellent satisfaction.

J. E. Harsh
Joplin, Mo.

12—34. We are anxious to have the best quoted authorities of commissions or railway boards against the use of cradles at railway crossings.

We understand that they are more of a menace than a safeguard, but wish to prove our contention.

Five years ago there was a universal demand on the part of railroad companies for protective structures of some kind beneath all high-voltage transmission wires crossing railroads, and in the East, including both the United States and Canada, this attitude of the railroad companies was so serious as to make the development of a transmission system almost impossible. As a result of a campaign of education, this company and its source of supply, the Ontario Power Company, have built in Ontario and throughout the western part of the State of New York about 120 crossings, and in no instance have we used cradles or protective structures of any kind or description. One

railroad after another withdrew its requirements in favor of excessively good line construction, and one after another these excessively good line construction conditions are being modified. This was largely brought about by reason of the broad-minded attitude of the engineers of and the Railway Commission of Canada.

I do not believe that any authorities have ever expressed a view that cradles or bridges are more a menace than a safeguard, because that would not be the case if they were properly built, but it is agreed that cradles or bridges are unnecessary and therefore undesirable, and this is concurred in by the Railway Board of Canada by direct action, and the Public Service Commission of the Second District of the State of New York by approval of crossings without such cradles or bridges, and the following railroads no longer require them: New York Central and Hudson River; Pennsylvania; Erie; Lehigh Valley; Delaware, Lackawanna and Western; Lake Shore and Michigan Southern; Grand Trunk; Michigan Central; Buffalo, Rochester and Pittsburg, and a number of others.

I have not the order of the Dominion Railway Board of Canada before me, but I know that up to two or three years ago their requirements were for a minimum size of No. 4 B. and S. gauge stranded cable, and the emphasis is placed on the desirability of stranded for such purposes.

Up to a very short time ago the Southern-Union Pacific system was most insistent in its demand for cradles, bridges or similar so-called protective construction at transmission crossings over their railroad, but a paper was read in San Francisco on May 5, 1910, by Allen H. Babcock, who is the chief electrical authority of that system, which indicates that they no longer require such so-called protective structures.

The American Telephone and Telegraph Company no longer request any such protection where high-voltage lines cross them, and there is now no occasion for such construction anywhere, and it behooves the transmission companies to employ the best possible line construction at railway crossings in order that the present record of immunity from accident shall continue.

F. B. H. Paine, General Manager
Niagara, Lockport and Ontario Power Company, Buffalo, N. Y.

I answer this question in a more or less general way, as I have no personal knowledge of positive instructions from anybody stipulating that cradles at railroad crossings are not to be used, but you will find in the crossing section of the Overhead Line Construction Committee's report last year that the discussion there indicates that their use is being abandoned, and in New Jersey we have gotten into difficulty with cradles over the Erie Railroad tracks at Tonnelle Avenue, Jersey City, by having the phase wires of the circuits get into the cradle in high winds, and we have recently convinced the Lackawanna people that the cradle at one of their heavy crossings is

an undesirable feature, and we are taking the same down, using clamping devices around the insulators for the supporting of the phase wires, believing it a much better scheme of construction than depending on the basket cradle to catch falling wires.

The Pennsylvania Railroad do not permit the use of cradles, although this information is handed out by their engineers to transmission companies making crossings over their tracks, and as far as I know, they have no printed instructions to this effect.

A few years ago cradles were extensively used but the general belief of most of the transmission engineers and nearly all the railroad engineers is now for clamping devices, such as suggested in the crossing section of the Overhead Line Construction Committee's report given at the 1910 Convention at St. Louis.

I cannot cite you any written instructions to this effect, but the above opinion, I believe, is a true one and the most up-to-date one on this subject.

Farley Osgood, General Superintendent
Public Service Electric Company, Newark, N. J.

With regard to the use of cradles at railway crossings, we do not seem to have any information as to the opinions of railway boards or commissions on the subject. We have, however, had the subject up with the engineers of the New York Central Railroad Company, the American Telephone and Telegraph Company, and the New York, New Haven and Hartford Railroad Company, all of whom have come to the conclusion that cradles under high-tension lines do not properly protect either a wire, highway or railroad crossing, and that the proper plan is to so design the overhead span that it will be strong enough to reduce danger of breakage to a minimum, and with grounding devices so that in case of a break the dangling wire would not be dangerous. In the form of construction approved by the New York Central Railroad Company for a railway crossing the overhead span is mechanically independent of adjacent spans, and in case of a break a falling wire becomes immediately grounded. The designs of the Telephone Company and the New York, New Haven and Hartford Railroad Company are similar. The Telephone Company also requires the overhead wiring to be stranded at the crossings.

I do not think of any place where cradles have proven a distinct menace, but from the above you will note that the trend of present engineering design is in another direction.

T. R. Beal
Poughkeepsie, N. Y.

There have been no general rulings by commissions, or railway associations, in regard to the use of cradles at crossings. The present tendency is strongly adverse to their use.

The Pennsylvania Railroad specifications of September 1, 1906, do not mention cradles, but by inference oppose them and as a matter of fact the Pennsylvania Railroad will not permit their use over their tracks.

The New York Central and Hudson River Railroad specifications of April, 1909, do not mention cradles, and as they show the construction desired, the inference is that cradles are not wanted; further I do not believe the New York Central and Hudson River Railroad will permit their use.

The specifications for overhead crossings carrying less than 700 volts and forming a part of the specifications of the Pennsylvania Lines West of Pittsburg state that "The licensee shall bear the sole cost and expense for the construction of such guard wires as, in the opinion of the superintendent of telegraphs of the railroad company, are necessary in order to protect the wires of the railroad company from all danger of contact with wires of the licensees." This is the only inference that cradles might be permitted, as their specifications do not contain the above clause.

The National Electric Light Association Committee on Overhead Line Construction and the A. R. E. & M. of W. Association Sub-Committee on Transmission Line Crossings are still working on the joint report on crossing specifications for general use, and while it would be improper for me to state in advance what the report will require when adopted, I am willing to say that in my opinion as member of both committees and chairman of the latter, the specifications will not permit cradles.

On pages 57 and 58 of the National Electric Light Association Report on Overhead Line Construction, St. Louis, 1910, I summarized the opinion of both committees and the general tendency in this country.

R. D. Coombs
New York.

13—7. What is the best system for locating faults on underground cables?

A complete and thorough discussion of this question may be found in the paper by Mr. W. A. Durgin, read at the technical session of the National Electric Light Association at its thirty-third convention, held May 23-27, 1910, entitled "Location of Faults in Underground High-Tension Power Cables."

E. O. Schweitzer
Chicago, Ill.

14—3. What is the relative cost per kilowatt at one-hour rating, of a storage battery and a direct-connected, 250-volt generator of equal kilowatt capacity?

Costs vary with the market and with the size of units, so that they cannot be definitely stated. However, the cost per kilowatt of storage battery will be about five times that of the generator (without engine or boiler equipment).

William Yeager
Brooklyn, N. Y.

14—4. Will member companies please give data showing relative cost of operating electric and horse-driven vehicles?

(a) What is the average kilowatt consumption of the three-ton truck?

(b) Of the ordinary runabout?

The relative cost of operating electric and horse-drawn vehicles naturally varies with every individual set of conditions, and there is, therefore, a very wide range of saving which may be made. We would say, however, that the cost of doing average work with electric vehicles will vary from 33 1/3 to 65 per cent of the cost for the same work with horse-drawn vehicles.

(a) About 720 watts per mile.

(b) About 120 watts per mile.

The Lansden Company
Per F. A. Whitten
Newark, N. J.

Concerning relative cost of operating electric and horse-driven vehicles, would say that this is really an engineering problem, and will depend greatly upon local conditions; for instance, electric trucks that will work satisfactorily and at high economy in Dayton, Ohio, would not work as well in hilly sections like Cincinnati, Ohio, and Kansas City, Mo. Some interesting information and data on the subject was published in the "Electrical World," January 13, 1910.

(a) From 650 to 750 kilowatt-hours per month.

(b) 100 to 125 kilowatt-hours per month.

F. M. Tait
Dayton, Ohio.

15—28. What is the practice in regard to the period of inspection of transformers in service? (Replies requested; also see December, 1909, "Bulletin," **Question 15—8; February, 1910, "Bulletin," page 264.)**

The Commonwealth Edison Company endeavors to inspect all of its transformers at least once in two years.

D. W. Roper
Chicago, Ill.

15—29. What is the general method of inspecting transformers in service? **(Replies requested; also see December, 1909, "Bulletin," Question 15—18; February, 1910, "Bulletin," page 264.)**

Bushings on the transformers are cleaned and examined, and the covers on the transformers are removed, and the oil level brought to the proper height if necessary.

D. W. Roper
Chicago, Ill.

15—30. What electrical tests are made on transformers in service? Give details of method of test. **(Replies requested; also see** December, 1909, "Bulletin," Question 15—8.)

The only tests which are made on transformers in service in Chicago are for the purpose of determining their load. These tests

are made with a current transformer of the split-ring type, which is placed in turn around each of the secondary leads.

D. W. Roper
Chicago, Ill.

15—38. Is it general practice to test for water in a transformer by inserting a tube to the bottom of the transformer, placing a finger over the top of the tube and thus drawing out a column of the contents, showing the amount of water in the bottom of the transformer? This is based on the principle that the water being of heavier specific gravity will precipitate to the bottom. Does this actually occur, or will the water in the transformer oil be distributed throughout the whole body of the oil in small particles?

It is general practice to take a sample of transformer oil for testing purposes in the method outlined. If water is present in large quantities it will precipitate to the bottom. If it is present in small quantities, however, this precipitation will occur only to a very slight degree, and will hardly be noticeable. The water will distribute throughout the body of the oil and will make the oil unsuitable for use in a transformer. As it requires only a small fraction of one per cent of moisture in transformer oil to reduce its dielectric strength 50 per cent, it is evident that this quantity of moisture present will be invisible, hence a test of the kind outlined is of use only in indicating water when it is present in large quantities.

R. D. DeWolf
Rochester, N. Y.

15—45. Two similar three-phase transformers operate satisfactorily in parallel. The primaries are connected delta, and the secondaries in star. On one of these transformers two of the primary phase leads and also the corresponding secondary phase leads of the same transformer are interchanged. What will happen? Why?

In this case the phase rotation in the secondaries will have been changed, and one will have double the normal secondary voltage in each phase, short-circuited on twice the normal impedence, which will have the same effect as the dead short-circuiting of both transformers.

John C. Parker
Rochester, N. Y.

15—48. Give diagram of connection for using two 2200-volt transformers on a three phase 2200-3800-volt system, with grounded neutral. All transformers on our three-phase system are connected star primary and delta secondary and when one transformer is out of service on the bank three-phase motors refuse to start.

If transformer A burns out it should be disconnected as shown

in diagram B. Then motors will start OK, but only 57.7 per cent load can be carried on the bank of transformers. It may in some cases be

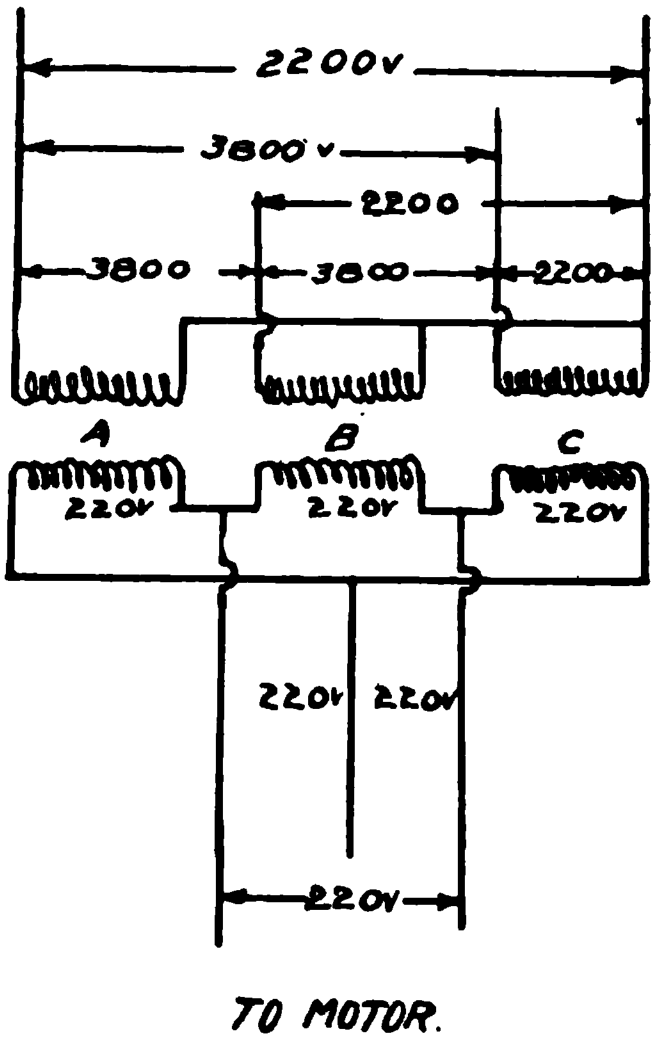


DIAGRAM "A"

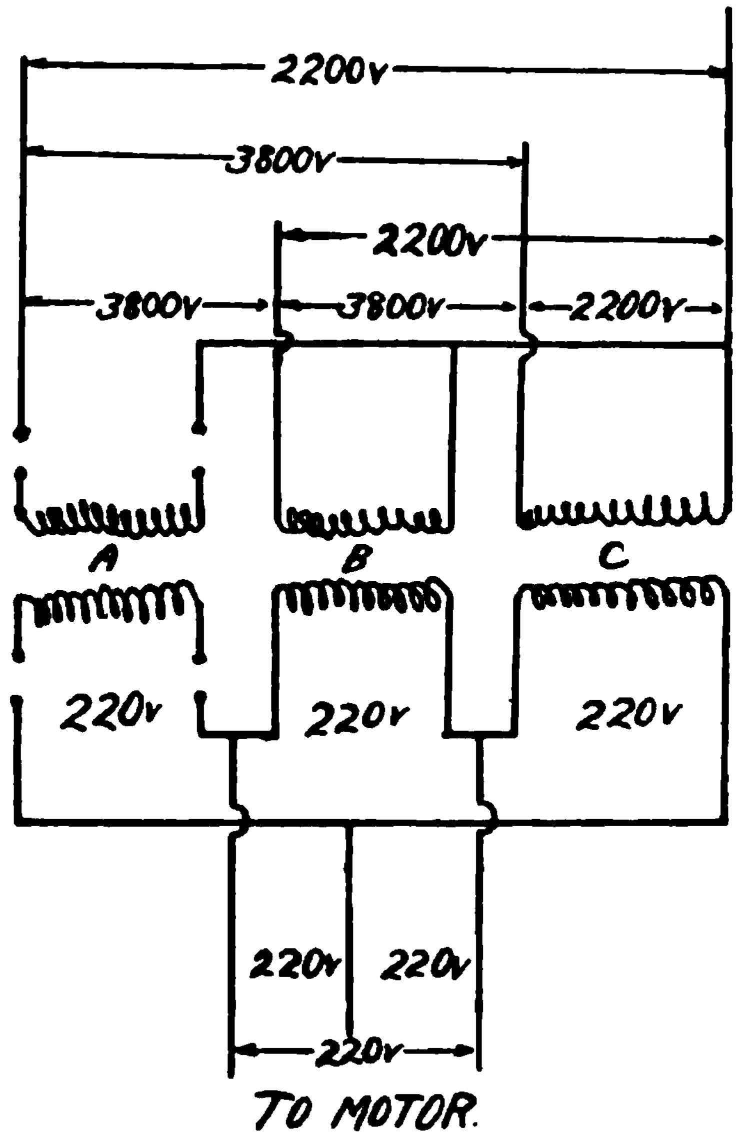


DIAGRAM "B."

possible to continue operation with defective transformer connected but it is poor practise.

R. M. Stevenson
Brooklyn, N. Y.

Two transformers may be connected to a three-phase system to perform the service of three transformers without interrupting the performance of the circuit, in a manner known as "Open Delta" or "V" connection. With such an arrangement there are certain changes which take place in connection with the transformer operation, but if conditions are normal three-phase motors may be started and operated continuously from the system without serious difficulty.

When three transformers are used and both primary and secondary windings connected in delta, the "V" connection may be obtained by simply removing one of the transformers, or if a three-phase transformer both windings of one element may be disconnected and short-circuited on themselves. No change need be made in other connections and the voltage ratio will remain as before.

If, however, as the question states, the primary winding is "Y" connected and one transformer were removed or short-circuited, the voltage ratio would be changed and would cause the secondary voltage to increase by $\sqrt{3}$. Although such a voltage increase would not be desirable for motor operation, it should not interfere with the motor

starting, except that it may cause the fuse on circuit-breaker to open.

The delta connection, of course, provides no point of neutral potential for a ground connection. The star connection must be employed if such a connection is necessary. **M. O. Jenkins**

New York City.

16—17. (a) Have any member companies tried a variety of makes of multiple tungsten lamps, from 25 to 250 watt, inclusive? (b) What make of lamp do you consider gives the best results? (Answers hereto will be considered confidential and will not be printed in the "Bulletin," but will be forwarded to the querist.—Editor.) **(c) Have you noticed a deterioration in candle-power in any of the different makes? (The manufacturers claim practically no deterioration in candle-power during the life of the lamp.)**

(a) This company has used two or three different makes of tungsten lamps, ranging from 25 to 250 watts. (b) We found a great deal of difference between the different makes. However, those we are now using give excellent satisfaction. (c) In our office we have been burning eight 100-watt lamps an average of ten hours a day; six of the original installation are still in use; one of the other two burned about 1500 hours and the other 2500 hours. When we renewed the last burned-out lamp we noticed a slight difference in candle-power, by the new lamp put in over the old lamps. These lamps have been removed several times and the shades washed and replaced.

J. E. Harsh,

Joplin, Mo.

16—24. What method is usually employed in making vacuum tests of incandescent lamps?

Commercial practise is to use an induction coil with secondary voltage high enough to give a spark from ½ inch to one inch. The testing is done in a dark room in the following manner: The lamp to be tested is held in the operator's hand and applied to one of the terminals of the secondary coil. The classification of vacuum is then easily made by observing the color of the glow which takes place in the bulb. A Geissler tube effect is obtained which shows the presence of any gas by its characteristic glow, the colors ranging from the purple of a poor vacuum up to a pale green and almost no color, with a good vacuum. **C. W. Bettcher**

General Electric Co., Harrison, N. J.

16—27. What is the candle-power of a 55-volt, 32-candle-power series carbon street lamp when operated at 62 volts?

The answer to this question, published in the last "Bulletin," is ingenious but not in line with the facts.

For a filament as heavily treated as this one would be it can be assumed that the candle-power will vary as the 5.2 power of the voltage; or at 62 volts, the candle-power will be

$$32\left(\frac{62}{55}\right)^{5.2} = 60 \text{ approximately.}$$

At this voltage the watts per candle would be decreased to 67.5 per cent of normal value, and the life would be reduced to about 10 per cent of normal. **Tyrrell Ferrier**

National Electric Lamp Association, Cleveland, Ohio.

Most lamp manufacturers claim that one per cent variation in voltage with carbon lamps will produce a corresponding variation of approximately five per cent in candle-power, hence, if a 55-volt lamp be operated on 62 volts, the voltage has been increased 12.7 per cent; the candle-power, therefore, has been increased five times this or 63.5 of the former value, or the change would be 20.32 candle-power and the lamp would be giving on 65 volts 52.32 candle-power, and of course at this voltage the watts per candle would be much less than 3.5 as assumed in the first answer. **C. E. Rose**

Little Rock, Ark.

16—29. The claim is made by manufacturers that the average life of the 50-watt Gem lamp is longer by at least a third than the life of the 16-candle-power carbon lamp. Will member companies please contribute information as to whether this claim is borne out by the facts? Have members data as to the actual life of the 50-watt Gem lamp in service?

A number of 50-watt Gem lamps were tested for life by the writer. He found that the life averaged about the same as the ordinary 16-candle-power lamp. He placed a row of Gems on one side of the office in the ceiling cove, and on the opposite side he placed the 16's. As they burned out they were counted. The actual data has been mislaid. **Eugene Creed**

Toronto, Canada.

16—30. What systems or methods have member companies, which supply free renewals, of guarding against theft of lamps?

In our lamp bureau we have an envelope for each customer showing his installation of incandescent lamps. When the customer calls for lamp renewals he presents lamp pass book. This book and the record in the lamp bureau envelope shows all previous transactions with lamps for the customer, and in the event of customer not returning a sufficient quantity of lamps to warrant renewal, he is charged for the difference, or if he has already secured what appears to be an unreasonable amount of renewals, his case is investigated.

On the base of tungsten lamps, we scratch the number of day in the year, when the lamps are delivered; when lamps are returned with claim, our lamp boy notices this number in order to ascertain whether lamps have been out over the guaranteed lifetime.

Geo. M. Valentine

Brooklyn, N. Y.

The consumer buys his first outfit of lamps from the company and the lamps have our label pasted on the bulb. He is given a lamp

card on which is entered the number of lamps and their size, and when he desires to renew his lamps he presents his lamp card and his lamps, and lamps are exchanged and entered on lamp card.

As we renew no lamps unless our label is on them, and the bulb is intact, the question of theft does not enter into the matter.

R. H. Silbert
Philadelphia, Pa.

The Georgia Railway and Electric Company etches all of its lamps with its initials. This has practically stopped the practise of theft.

William Rawson Collier
Atlanta, Ga.

We have a card system to protect ourselves from theft of lamps with our free renewal customers.

Each customer has a card which must be presented with the lamps and the number and type of lamps are punched thereon for each renewal. This gives us, at a glance, the customer's rate of exchange, and by checking his installation we very soon find out whether he is renewing them honestly or for outside parties.

C. E. Rose
Little Rock, Ark.

17—22. Colored sources of artificial illumination modify color values considerably. Is there any table of the resulting color produced by various light-sources on original color values?

[A table such as is asked for in this question is found in Transactions of the Illuminating Engineering Society, for May, 1907, and is entitled, "The Effect of Colored Lights on Aniline Dyed Materials. From tests by M. Chevreul at the Gobelin Tapestry Works. With additions by W. D'A. Ryan."

Orange	rays	falling	on	white	make	it	appear	orange.
"	"	"	"	red	"	"	"	reddish-orange.
"	"	"	"	orange	"	"	"	deeper-orange.
"	"	"	"	yellow	"	"	"	orange-yellow.
"	"	"	"	green	"	"	"	dark-yellow-green.
"	"	"	"	blue	"	"	"	dark-reddish-gray.
"	"	"	"	violet	"	"	"	dark-purplish-gray.
"	"	"	"	black	"	"	"	brownish-black.
Red	"	"	"	white	"	"	"	red.
"	"	"	"	red	"	"	"	deeper-red.
"	"	"	"	orange	"	"	"	orange-red.
"	"	"	"	yellow	"	"	"	orange.
"	"	"	"	green	"	"	"	yellowish-gray.
"	"	"	"	blue	"	"	"	violet.
"	"	"	"	violet	"	"	"	purple.
"	"	"	"	black	"	"	"	rusty-black.
Yellow	"	"	"	white	"	"	"	yellow.
"	"	"	"	red	"	"	"	orange-brown.
"	"	"	"	orange	"	"	"	orange-yellow.

Yellow	rays	falling	on	yellow	make	it	appear	deeper yellow.
"	"	"	"	green	"	"	"	yellowish-green.
"	"	"	"	blue	"	"	"	slaty-gray.
"	"	"	"	violet	"	"	"	purplish-gray.
"	"	"	"	black	"	"	"	olive-black.
Green	"	"	"	white	"	"	"	green.
"	"	"	"	red	"	"	"	yellowish-brown.
"	"	"	"	orange	"	"	"	grayish-leaf-green.
"	"	"	"	yellow	"	"	"	yellowish-green.
"	"	"	"	green	"	"	"	deeper-green.
"	"	"	"	blue	"	"	"	bluish-green.
"	"	"	"	violet	"	"	"	bluish-gray.
"	"	"	"	black	"	"	"	dark-greenish-gray.
Blue	"	"	"	white	"	"	"	blue.
"	"	"	"	red	"	"	"	purple.
"	"	"	"	orange	"	"	"	plum brown.
"	"	"	"	yellow	"	"	"	yellowish-gray.
"	"	"	"	green	"	"	"	bluish-green.
"	"	"	"	blue	"	"	"	deeper-blue.
"	"	"	"	violet	"	"	"	deep bluish-violet.
"	"	"	"	black	"	"	"	bluish-black.
Violet	"	"	"	white	"	"	"	violet.
"	"	"	"	red	"	"	"	purple.
"	"	"	"	orange	"	"	"	reddish-gray.
"	"	"	"	yellow	"	"	"	purplish-gray.
"	"	"	"	green	"	"	"	bluish-gray.
"	"	"	"	blue	"	"	"	bluish-violet.
"	"	"	"	violet	"	"	"	deeper-violet.
"	"	"	"	black	"	"	"	violet-black.

This table has evidently been reprinted since, for Mr. Tyrrell Ferrier, of the National Electric Lamp Association, Cleveland, in a reply to 17—22, is kind enough to supply the entire identical table, explaining that it is taken from the "Electrical Engineer," May, 1908, page 395. There seems to be little doubt, however, that the table was first printed in the Transactions referred to in the foregoing.—Editor.]

17—25. Will member companies kindly give any experience they may have had in the operation (a) of electric signs wired in series multiple, using 12-volt tungsten sign lamps and (b) operated with a five-point flasher? If companies have had no experience with these lamps and flashers an opinion would be appreciated.

With this company we have about 75 electric signs using 12-volt tungsten sign lamps in multiple. Several of these are operated by flashers. One of these is a shoe sign using a 20-point flasher. With the shoe sign we had a little difficulty at first on account of loose connection; however, the sign is working nicely now.

J. E. Harsh
Joplin, Mo.

[An article which will doubtless prove of interest to the member

company asking this question will be found on page 504 of the September 1, 1910, issue of the "Electrical World." It is entitled, "Development and Application of the Tungsten Lamp for Sign Lighting in Minneapolis, Minnesota."

This article maintains that the low efficiency of the two and four candle-power carbon sign lamp as compared with larger incandescent units was a handicap to sign and decorative lighting, and records that the Minneapolis Company has been advocating tungsten sign and display lighting with the lamps in series-multiple, a method of connection which has proven entirely satisfactory; and that since the inauguration of this campaign, "scores of additional signs have been installed, containing lamps ranging in numbers from 110 up, embodying many striking features." The rate charged is six cents net per lamp per month for the five-watt tungsten lamp on a flat rate schedule of five hours nightly burning, which rate is exactly one-quarter of the four-candle-power carbon sign-lamp rate, which is 24 cents net per lamp per month on the same time schedule. The tungsten rate, however, does not include any lamp cost, which is invariably borne by the customer.

The claim is made in this article that in case one or two lamps of the multiple groups burn out, the rise in voltage of the remaining lamps in the group is not sufficient to subject them to undue strain, and does not shorten their life to any appreciable extent.

A case is reported where 154 of these five-watt, 12-volt lamps have been burning in a sign for over 2500 hours with a loss of only one lamp, which went out after 2300 hours burning. Upon replacement, it was impossible to distinguish the exact location of the new lamp, indicating that the other lamps had lost little of their brilliancy in spite of their long use.

The article concludes with this significant statement: "National advertisers should certainly employ it (the tungsten series-multiple sign system) as the main or basic feature of advertising campaigns, and the tungsten sign lamp puts the electric light company in a strong position to talk efficiency of expenditures in this direction. Outline lighting should also receive considerable impetus, as the series-multiple system of wiring for this purpose is most simple, and should be less costly than multiple wiring, the former method permitting of the spreading of a single circuit well over the front of most buildings."—Editor.]

17—26. Has any member company had any experience in lighting tennis courts? If so, please state method.

Two of the court tennis courts in Boston are lighted very satisfactorily by the use of Cooper-Hewitt lights, one on our service and one on a private plant. Approximately 18 lights are used aggregating seven kilowatts on direct-current service, hung high above the court. The effect is very good because the lights do not dazzle the eye even when looked at.

There are quite a number of squash and squash-racquet courts

using in some cases tungsten lamps, in other cases six-ampere direct-current arc lamps. In these courts it is very simple to shade the lights so that the eye does not see them and yet the lights illuminate the court satisfactorily.

I should think that lawn tennis courts could be lighted satisfactorily in the same way as the court tennis court, and believe there are a number in New York lighted either by Cooper-Hewitt lights or arc lights.

R. S. Hale
Boston, Mass.

We have lighted croquet grounds with eight 32-candle-power lamps, four on each of the long sides, equally spaced and hung nine feet from the ground with metal reflectors. Results were very satisfactory to the players, and we think same plan would answer for tennis, with perhaps a slight increase in number of lamps.

D. W. Emerick
Fulton, N. Y.

Would suggest that the method used in Northwestern University Gymnasium be tried. This is described in one of the June or July numbers of the "Electrical World" and is effected by the use of silvered glass reflectors hung high and using tungsten lamps.

Lloyd Garrison
Ogden, Utah

[An editorial appearing in the "Electrical Review" of September 24, 1910, is of interest in connection with this question, and, being brief, is here reproduced.- Editor.]

ELECTRIC LIGHTING FOR OUTDOOR SPORTS.

In addition to the electric lighting of baseball parks, as already reported in a previous issue of the "Electrical Review and Western Electrician," there is a field ready for development for the electric illumination of smaller areas for outdoor sports at night time. There are many popular games, as tennis, croquet, curling, basketball, handball, fives, and the fine old English game of bowls played on a greensward, which should afford a splendid opportunity for night illumination if the central stations care to solicit this kind of business. The lighting problems involved in these and other similar cases are easy of solution, and the aggregate business which would result from a determined campaign should well be worth the effort.

18—5. Will some companies give their experience with electric washing machines. How have they been placed on the lines and do they prove satisfactory to customers after sale?

We have sold several hundred electric washing machines, and find that they are universally satisfactory. In fact, we have had less trouble with these than with any other motor-equipped appliances sold. I know of only one case where a washing machine was returned after being paid for, and this was not the fault of the washing machine

Our method of introduction is the same as for other appliances, i. e., advertising and soliciting, including the following up of leads. Most of the orders secured are for machines to be sent on approval with the privilege of returning within a certain time, usually thirty days.

George B. Johnson
Chicago, Ill.

Our experience has been very satisfactory. We put the machines out on two or three weeks' trial, and so far have only had one returned. and that was a machine which should never have been sent. In case of any trouble with machines, all we have to do is to notify the Thor Company, which maintains a repair service free of charge. Sales are made principally as a result of advertising, although we do some soliciting in this field.

(Miss) G. A. Monsees
Brooklyn, N. Y.

Have had experience with a few machines which we sold direct to consumer; outside of having trouble with some parts of the wringer, the machine is perfectly satisfactory.

J. M. Fried
Poughkeepsie, N. Y.

The North Shore Electric Company has placed some thirty washing machines on its lines in the last six months under the following plan: Customer is given two weeks' trial free and then, if he cares to, he can purchase the machine. He is allowed to pay for it with his lighting bills, in twelve equal installments. We have had only one machine returned.

George R. Jones
Chicago, Ill.

The writer has placed many electric washing machines in residences, attaching them to the ordinary lamp sockets, and they have given entire satisfaction, so far as he knows; in fact, they were placed on thirty days' trial before the sale was made.

Eugene Creed
Toronto, Canada

We are encouraging the sale of the electric washer. We have quite a number of these on our lines. I regard them as the best proposition that we have to offer the domestic customer. We sell them on either a cash or an installment basis, and give two weeks' free trial. There have been practically no complaints. The general opinion of the machine and its performance is that of enthusiasm. Many persons put in the electricity simply to run a washer.

A. G. Rakestraw
Wilkinsburg, Pa.

We have a large number of electric washing machines on our circuits. They have been sold entirely by the electrical supply houses in the usual way, and give excellent satisfaction to the customers.

B. W. Mendenhall
Salt Lake City, Utah

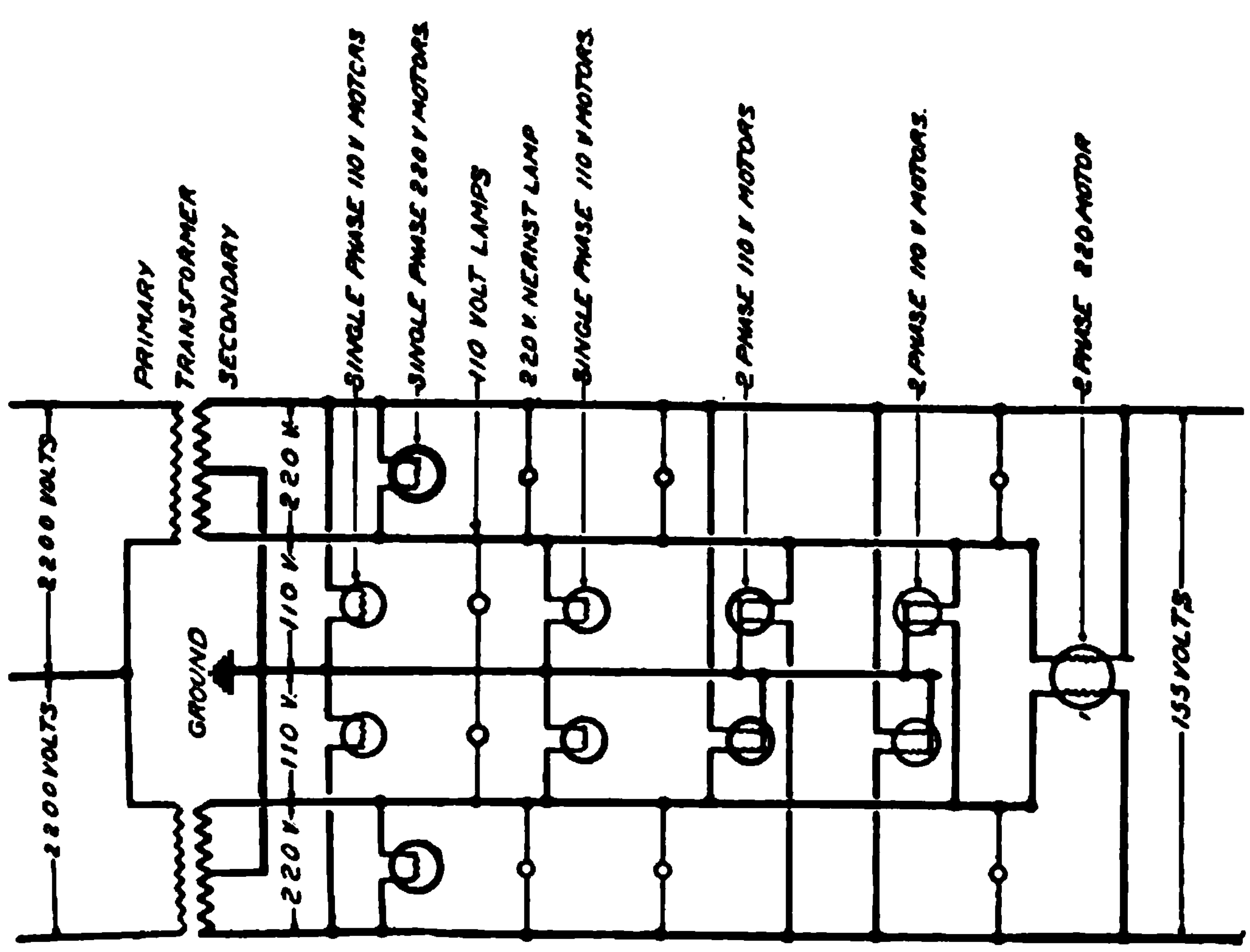
We do not handle washing machines, as there are several dealers in the city who handle same; but we have allowed the different agents to demonstrate their washing machines on our floor, and they have been successful in closing sales.

We have not had any complaints against them; we have heard many consumers speak in favor of them. We believe in securing motor driven washing machines on the lines directly through the agents, thereby eliminating possible maintenance expense.

C. F. Schake
Rochester, N. Y.

19—26. With what degree of success have member companies operated five-wire two-phase secondary systems for power and lighting?

The accompanying diagram shows all the connections of the five-wire, two-phase system of secondary distribution which are commercially used in Philadelphia. Load should never be connected between either outer wire of one transformer and an outer wire of the other, as this causes unbalanced voltages, low power-factors, and is otherwise unsatisfactory. The voltage between these connections, however, is shown in the diagram. This system is exceedingly efficient in regard to the amount of copper necessary to carry a given load with a given



drop of potential. Assuming the copper in a single-phase, two-wire system of equal minimum voltage, as for instance, 110 volts, at 110 per cent, the amount of copper necessary to carry the same load, using the five-wire, two-phase system with the same voltage, would be 31.25 per cent. or 5-6 x 37.5 per cent. (Steinmetz "Phenomena," page 473, 1900).

A. R. Cheney
Philadelphia, Pa.

The five-wire system in Philadelphia has proved satisfactory when the motors connected operate under practically a constant load. Where the load is intermittent, the lamps flicker.

John Meyer
Philadelphia, Pa.

19—81. What has been the experience of member companies in operating the steam electric plant of a large customer to furnish power not only to the customer but to feed back current into the company's mains?

The Commonwealth Edison Company has in a number of instances furnished power to street railway systems and also in a very few instances to industrial and commercial establishments in which part of the customer's load was carried by himself on his own power plant. There is no physical reason why this cannot be done satisfactorily with suitable equipment and proper conditions of operation, even to the extent of running the two sources of supply in parallel. As a general proposition, however, it is a condition that should be avoided wherever possible.

P. Junkersfeld
Chicago, Ill.

[The experience of the Commonwealth Edison Company is told in considerable detail in a paper by Mr. S. M. Bushnell, on "Central-Station Operation of Steam Plants in Connection with Lighting Company Service," presented before the 1909 Convention of the National Electric Light Association at Atlantic City. Mr. Bushnell tells of the operation of the Illinois Maintenance Company, a subsidiary of the Commonwealth Edison Company, and relates how combination service is supplied in 27 buildings in Chicago, most of which business it would have been impossible to secure if the company had not operated the local steam plant of the customer. No current, however, in any of these cases is fed back into the company's mains.

A paper relating to this subject, and entitled "Decentralized Plants," was also presented before the recent St. Louis Convention by Mr. R. D. DeWolff, of Rochester, N. Y.—Editor.]

19—85. In industrial plants where the air is heavily laden with coal dust, is a three-phase, 25-cycle locomotive preferable to a 500-volt, direct-current locomotive for yard haulage?

It would be far better to use a three-phase, 25-cycle locomotive than a 500-volt direct-current locomotive for yard haulage where the air is heavily laden with coal dust, since you would experience no commutator trouble and, in view of the fact that a government report recently made at Pittsburg shows that a large per cent of mine explosions are caused by coal dust rather than fire damp, you have the additional protection of no sparking.

C. E. Rose
Little Rock, Ark.

19—87. What is the maximum size (horse-power) motor accepted on single-phase circuits by member companies?

Not over 7½ horse-power under any circumstances, and not over

three horse-power if we have three-phase secondaries within 300 feet of installation.

N. F. Lewis
Scranton, Pa.

One horse-power or less may be 110 volts, single-phase. Single-phase motors, up to and including five horse-power, may be used, but motors exceeding one horse-power must be 220 volts. Single-phase motors in excess of five horse-power must not be installed except by special permission of the company.

R. H. Silbert
Philadelphia, Pa.

Five horse-power under ordinary circumstances. In special cases 7½ horse-power is allowed if satisfactory regulating device is attached.

William Rawson Collier
Atlanta, Ga.

One horse-power 110-volt, three horse-power 220-volt.

T. J. Hancock
Montgomery, Ala.

7½ horse-power.

J. M. Fried
Poughkeepsie, N. Y.

We accept a 7½-horse-power motor as the maximum size on our single-phase circuits.

W. T. Fairbairn
Brooklyn, N. Y.

This company does not permit the connection of a larger motor than a five-horse-power, 220-volt in the residence district; on our downtown circuits a two-horse-power is the maximum.

J. E. Harsh
Joplin, Mo.

Five horse-power, 220 volts is the largest size single-phase motor which this company permits on its lines. We have found by experience that any single-phase motor larger than the above capacity causes, on the starting load, an excessive fluctuation of the line voltage.

A. P. Good
Chicago, Ill.

19—38. Do member companies experience trouble through installation of starting devices (used in connection with alternating-current motors) which require inordinately high starting current?

What regulations are in force by stations governing amount of current permitted in starting devices?

No motor is allowed on the system that demands more than three times running current at starting.

William Rawson Collier
Atlanta, Ga.

Yes; we experience considerable trouble in connection with the installation of starting devices for alternating-current motors on our

system. We will not connect motor installations where motors are installed requiring starting devices in connection with same, unless our rules governing the installation of starting devices are complied with by contractors.

Starting devices must be installed on motors of three horse-power and over on our alternating-current system in accordance with the following rule: Starting devices: Approved starting devices must be provided for all two-phase motors of five horse-power and over, and single-phase motors of three horse-power and over. Such device must limit the starting current to less than twice the normal full-load current per phase of the motor.

W. T. Fairbairn
Brooklyn, N. Y.

19—39. How large a motor do member companies permit to be installed on lighting circuits?

Not over one-half horse-power.

N. F. Lewis
Scranton, Pa.

Motors not exceeding one-half horse-power, 110 volts, and if more than one such motor is installed, they must be balanced on the three-wire system. This provides for fans.

R. H. Silbert
Philadelphia, Pa.

We have a few 10-horse-power motors in use on lighting circuits, using separate transformer on each and Tirrill regulator at station. However, where the power business will justify the expense it is preferable to install a motor circuit.

J. H. Enright
Frederick, Md.

All alternating-current circuits in Atlanta carry both light and power installations and no maximum-power installation is specified. On some of the three-phase lines motors of 50 and 75 horse-power are installed and very little trouble is experienced from regulation.

William Rawson Collier
Atlanta, Ga.

Assuming that power for motors and light is to be taken from the same transformer and that the motor is to be used during the day only, say from 7:30—5:30, the maximum limit should be fixed at 10 horse-power. In the case of a motor operating intermittently during the day and night, as for example, on a Perry Automatic Water Supply System, a lower limit should be taken. If the power for lighting is very great as compared with that used for motors, this maximum limit should be raised to a higher value than given above. The choice of this limit is influenced to a great extent by the location of the motor, whether at the near or far end of the line.

The operation of motors and lamps on the same transformer should be discouraged as much as possible.

Robert A. Lutz
Waukegan, Ill.

One horse-power. **J. M. Fried**
Poughkeepsie, N. Y.

We will permit motors of three-quarter horse-power and under, either 115 or 230 volts to be connected on our lighting circuits.
W. T. Fairbairn
Brooklyn, N. Y.

It is usual to allow small sewing-machine motors and motors, say up to one-quarter horse-power, on lighting circuits. It is not considered good practice, however, for larger sizes.
Eugene Creed
Toronto, Canada.

It is not good business to limit the size of motors, but attention should be given to the character and uses of the installation to prevent bad flickering of lights during lighting hours. The proper place to attack the problem is in the regulation from the station and in the adequacy of the distribution system and design of the consumer's installation. This company feels that the sanctity of lighting circuits may be made a fetish, which in the end will result in higher costs to consumers than is consistent with the superlative excellence of service rendered to residence-lighting consumers. Moreover, the separation of the services may prevent the securing of large and lucrative custom where the general density of business may not be sufficient to warrant two services. **John C. Parker**
Rochester, N. Y.

With this company nothing larger than a one-horse-power motor is permitted on lighting circuits. **J. E. Harsh**
Joplin, Mo.

Beg to advise that in our direct-current districts both light and power are on the same service mains. In the alternating-current districts small motors of one-half horse-power are fed from the lighting transformer. For larger motors separate transformers are installed.
Yours very truly,
Geo. H. Jones
Power Engineer.

20—53. (a) Are any member companies installing prepayment electric meters, and what degree of success have they had? (b) What styles of meters are being used? (c) Have any of these meters been installed for any considerable length of time?

The North Shore Electric Company installs prepayment meters on such customers as saloons, or the cheaper restaurants, people who refuse to put up a deposit. We empty these meters according to the amount used, generally twice a month. With the newer type prepayment meters made by any reliable meter company we experience no

trouble. If properly installed, they are practically impossible to beat. We have had several prepayment meters installed for several years.

H. B. Williams
Chicago, Ill.

It has been the practise of this company for the past three or four years to install Westinghouse prepayment meters on customers of bad credit and from whom we were unable to get a deposit. We have had about 65 of these meters installed and have found them mechanically fairly satisfactory. The only trouble we have experienced with them is in having the quarters stick in the slot and in some cases having the entire meter broken up or stolen. Our receipts from these meters will average $4.00 per meter per month. We require the customer to pay a minimum bill of $1.25, should it happen that he does not place that much in the meter. **J. P. W. Brown**
Nashville, Tenn.

21—9. Kindly give information on floats used in such as Fourth of July parades and for advertising purposes.

A float used in the Rochester Industrial Exposition this year consists of an overshot water-wheel, eight feet in diameter, belted to a five-horse-power motor, and mounted on a 3½-ton electric truck; the combination typifying the generation of electric energy by water power. A motor-driven triplex pump, which is concealed from sight, circulates water over the wheel, the water being caught in a tank at the bottom and returned again to the top of the wheel. Large leads run from the motor to the corners of the float, where they are connected with electric fans, the fans being run from the truck battery, but appearing to be driven from the motor. Suitable cards inform the onlookers to "Use Electric Power," "Use Electric Lights," and to "Use Electric Trucks." Evergreen trees and autumn leaves furnish a suitable primitive setting for the old water-wheel.

For an illustrated description of a float used a year ago, see "Electrical World" for November 11, 1909.

F. L. Bolton
Rochester, N. Y.

[The Brooklyn Edison Company had constructed and used in the Mardi Gras parade of Coney Island, a year or two ago, a large float, the main feature of which was half-a-dozen enormous imitation incandescent lamps, hollowed out, in each of which was seated a very pretty young lady, suitably dressed. These large incandescents were lighted inside by miniature lamps and lamp streamers connected them. The whole was mounted on an electric truck with suitable signs. The construction of this float cost something over $500, and the company did not consider it a brilliant success.—Editor.]

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The

writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass. Let them come!

A power advertisement which can be used in any locality and which has brought results. **N. F. Lewis**
Scranton, Pa.

THERE IS A REASON

Why did The Throop Silk Throwing Co. equip their new mill with motors and contract with THE SCRANTON ELECTRIC CO. for power.

Why did The Clemons Silk Co. The Providence Silk Co. and many other silk weavers and throwsters discard their engines for motors and buy power from THE SCRANTON ELECTRIC CO.

Why do 80% of the planing mills in the valley *buy* power of THE SCRANTON ELECTRIC CO.

Because Electricity is the best and most economical power known and THE SCRANTON ELECTRIC CO. can furnish it cheaper than the manufacturers can make it for themselves—

THE SCRANTON ELECTRIC CO.

21—15. Is it feasible for us to furnish power to operate the local fire-alarm system from our 110-volt direct-current mains, or can it be done from a motor generator set? It takes about 80 gravity cells to keep up the system (the Gamewell) and costs $125 per year for chemicals. Besides cost of chemicals (acid, blue vitriol and lead plates) it costs $300 per year salary of man to keep battery in condition. Would like to have the experience of member companies who have operated such systems from central-station mains as to kilowatt-hours required, apparatus necessary, cost of same and all details.

It is entirely feasible to operate this system from your 110-volt direct-current mains. A small storage battery should be installed to insure uninterrupted service; also a reverse current relay to prevent the battery discharging into generator in case of trouble. The amount of current consumed in this device would be very small. Assuming a current of one-half ampere (a liberal allowance), the annual consumption would be under 500 kilowatt-hours. Under these conditions it seems to me that the proper way to handle the business would be to make a flat rate. **R. M. Stevenson**
Brooklyn, N. Y.

I do not believe it wise to depend entirely on a station supply for this service. The actual energy in watt-hours required, is a small matter compared with continuity of service. In large systems it is usual to have duplicate storage batteries charged by motor generator. I would suggest a small battery floating on the load as in telephone

practice. This would keep the lines working in the event of a temporary cut off of the central station. If the service warrants, this, it would be much cheaper than a primary battery. The station should take the work on a flat rate considerably in excess of its regular rates so as to maintain the battery.

Joseph F. Putnam
Rochester, N. Y.

22—26. Has any company adopted a rule of charging customers for transformers in three-phase motor installations of fifty horsepower and above?

Our sliding scale schedule of rates provides for electric service at 110, 220 or 440 volts, so that we provide and maintain transformers regardless of size. However, we also sell high-tension energy on the horse-power-year basis, in which case the customer provides the transformers.

H. W. Peck
Rochester, N. Y.

22—30. Is the actual net profit per $1.00 of gross income greater or less when current is sold to residences at a flat rate of $120 per kilowatt-year of customer's controlled demand in connection with tungsten lamps at present prices or when sold at 11 cents per kilowatt-hour with uncontrolled demand and free renewals?

As pointed out by one correspondent, no fixed rule can be laid down. Neither can the above problem be solved with the information given. As an example, however, we may assume certain conditions, in order to show how the problem may be solved when all the facts are known. Let us assume that the fixed charges amount to $30 per kilowatt of station capacity, which would be 12½ cents per 50-watt unit per month, also that the variable charges are three cents per kilowatt-hour delivered on the customer's premises. The cost of lamp renewals we will take as one cent per kilowatt-hour. We will compare two small residences, each having a maximum demand of five lamps, or 250 watts, and assume that the party on the flat rate burns these five lamps for six hours per day, which gives a consumption of 45 kilowatt-hours per month. We will further assume that the meter customer, who will be naturally more saving of his light, uses only three lamps for four hours per day, but with the same maximum demand. We then have for the flat-rate customer:

Cost		Receipts	
45 kilowatt-hours at 3 cents..	$1.35	Flat rate, ¼ kilowatt.........	$2.50
Fixed charges	.63		
	$1.98		$2.50

Profit, 21 per cent.

The question of whether this customer burns carbon or tungsten

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lamps will not affect the profit made by the company. Consider now the meter customer:

Cost		Receipts	
18 kilowatt-hours at 3 cents..	$0.54	18 kilowatt-hours at 11 cents.	$1.98
Lamp renewals	.18		
Fixed charge	.63		
	$1.45		$1.98

Profit, 27 per cent.

Now to show the effect of heating apparatus upon the profits, assume that this party also uses an iron during the month, consuming 12 kilowatt-hours, none of which comes on peak. We then have:

Cost		Receipts	
30 kilowatt-hours at 3 cents..	$0.90	30 kilowatt-hours at 11 cents.	$3.30
Lamp renewals	.18		
Fixed charges	.63		
	$1.71		$3.30

Profit, 48 per cent.

A. G. Rakestraw
Wilkinsburg, Pa.

If we assume the average residence customer has a load-factor of 10 per cent, then the gross income per kilowatt of a consumer's demand with current at 11 cents per kilowatt-hour and uncontrolled demand gives a revenue of $95.00 per kilowatt per year. Investigations by H. B. Gear, of Chicago, as published in the August "Proceedings of the American Institute of Electrical Engineers," indicates that the diversity factor under these conditions is 6.20, let us say in round numbers 6, so that the gross income per kilowatt of demand on the generating equipment is $570 per annum. While we know of no figures to prove it, we think that the diversity factor in the case of the controlled flat rate would not exceed three, so that the gross income per kilowatt on demand of the generating station would be $360 per annum, or a gross income of $210 greater in favor of the uniform meter rate. Since the load-factor would be greater and the diversity factor less, those expenses which are proportional to the consumer's demand and consumption would be greater per kilowatt of generating demand in the case of the controlled flat-rate. The expenses which are proportional to the number of consumers would be approximately the same in either case, so that the profit should be much greater in the case of the meter rate with uncontrolled demand. Even were the diversity factor as six to five, we believe the higher load-factor and lower diversity factor would have the effect of rendering the controlled flat rate less profitable.

We do not know how the matter of the use of such appliances as electric flat-irons, electric toasters, washing machines, fans, vacuum

cleaners, etc., is handled in the case of the controlled flat rate. A flat-iron would have a demand of one-half kilowatt, and few of the customers would feel justified in contracting for a flat-rate of $60 per annum in order to use this convenience. This appears to be a serious objection to such a system. B. W. Mendenhall
Salt Lake City, Utah

23—16. (a) We are desirous of obtaining comparative figures from various electric lighting companies, showing the percentage that the maximum peak demand bears to the connected lighting load. Where it is possible, we should like to have the light segregated from the power load. (b) We should also like to learn of any legal rulings on this subject, and information as to how the courts have decided with respect to the percentage of a property chargeable to the lighting end of the business would be most acceptable.

The percentage of maximum demand to connected load varies according to the kind of business and method of operation, usually running from 30 per cent to 40 per cent. It is higher in a modern station where the current is generated as alternating-current and transformed to direct than in a station where the current is used as generated, since the loss in transformation increases the station peak.

R. S. Hale
Boston, Mass.

It is very difficult for us to state absolutely the relation of our commercial peak load to our connected commercial load on account of the fact that we are selling large quantities of power to the street railways from the same station. We cannot separate the power from the lighting load on the commercial circuits because they are fed from the same mains. The following figures are reasonably accurate as to our conditions:

Maximum commercial power and lighting load....... 82,400 kilowatts
Total connected commercial power and lighting load..262,302 kilowatts

E. W. Lloyd
Chicago, Ill.

Maximum peak demand, 32,000 kilowatts; connected load (not segregated), 94,800 kilowatts; percentage. 33¾ +.

W. F. Wells
Brooklyn, N. Y.

I do not think any company of any size could give information of value in answer to this question. Any one of us ought to be able to tell our connected lighting load, but only those of us who originally kept power on separate circuits (which none of us have done for a great many years) could give an answer that would be anything more than a guess.

As to legal rulings (23—16b) I am quite certain that no court or commission has yet made such a decision, separating the capital

charges between the light and the power business as light and as power. But the decision of the Railroad Commission of Wisconsin in the Menominee and Marinette Light and Traction case discusses the division of capital charges between gas, railway and light, and goes on to analyze the street lighting, commercial lighting and power business after a fashion which will be very useful to the inquirer. The date of the decision is August 3, 1909. I have no doubt that the Railroad Commission of Wisconsin, Madison, Wis., will forward a copy on request.

Alex Dow
Detroit, Mich.

24—20. Do central stations which sell current by meter encourage or discourage the use of low-voltage transformers and low-voltage lighting systems for residences? In either case, what are the methods pursued to obtain the desired result? State reasons for policy followed.

The writer believes that for a central station to either encourage or discourage the use of low-voltage transformers in connection with residence lighting would be a waste of time. There are very few residence consumers who would care to invest ten or twenty dollars in a transformer, and say from thirty-five to seventy-five cents each for lamps, for the sake of saving a few dollars a year. As the average domestic is very careless the breakage of lamps is very high.

If a customer is found who is using the low-voltage lamps, simply call his attention to the manifold uses of the electric flat-iron, toaster, washing machine, sewing-machine motor, etc., and if you sell him you will be getting additional revenue for yourself and doing the consumer a favor.

Eugene Creed
Toronto, Canada

We do not encourage the use of low-voltage transformers and low-voltage lighting systems for residences. We have not found it necessary to discourage their use.

We have always taken the position that manufacturers would produce a tungsten lamp with substantially the same strength as a carbon lamp, and that pending that time it would be unwise to adopt special voltages, particularly in view of the fact that these low-voltage lighting systems limit the use of electric irons, toasters, vacuum cleaners, etc., unless separate outlets are provided, which might involve considerable expense. Our gross revenue from residence customers for the fiscal year ending June 30, 1910, showed an increase of 21 per cent over the preceding fiscal year, while the number of residence consumers for the same period showed an increase of only 16 per cent. The tungsten lamp was introduced quite generally into our residences during the last year, so that there should have been a reduction in our revenues rather than an increase; but the addition of such appliances as are named above, and others, has overcome the effect of this reduction in wattage and added a five per cent greater increase in our

income. We believe that the adoption of any system which would discourage these appliances would be a serious mistake.

B. W. Mendenhall
Salt Lake City, Utah

24—23. Are there any companies in cities of over 100,000 which have done away with deposits, i. e., discontinued requests for deposits, and extended credit to practically all applicants? If so, what has been the results?

There are certain sections of our territory, in population equal to the above, in which no deposits whatever are required, except for moving-picture shows. The result is, of course, that we get a good many connections that we otherwise would not, and a good many that we would be better off without. I doubt if there is very much business which is really worth having that we could not secure as well if deposits were asked. We do not let the matter of deposit stand in the way of getting a customer whom we know to be reliable, even where we make a rule of asking for deposits.

A. G. Rakestraw
Wilkinsburg, Pa.

The Brooklyn Company accepts all orders taken by the sales department where a customer's wiring is installed and certificates have been properly issued by the authorities. We have a standard credit rule requiring either a satisfactory commercial rating, a guarantee deposit, or in lieu of either, a written guarantee from some responsible party. Our deposits are based on an estimated usage covering two months' charges.

If we cannot approve the credit on an order by any of the foregoing means, we place the account on a weekly basis with a reduced deposit, or as a final resort, on a weekly basis without a deposit, excepting where the expense involved to give service is above the average and the applicant is unworthy of credit, in which case it may be better not to take the business.

This is, practically, extending credit to all applicants, and our experience has been with our present system of handling the accounts very satisfactory; our losses, due to unpaid bills, being very small:

J. D. Campbell
Brooklyn, N. Y.

24—25. What natural rate of increase in gross income from current sales from year to year may fully be expected in cities of 8,000 inhabitants?

Fifteen per cent per year.

O. C. Cover
Goshen, Ind.

If salesmen are employed who know their business and are capable of getting results, you can look for an increase of at least 33 1/3 per cent. If not, as the president of one of the largest companies said: "Be careful you do not show a decrease."

Eugene Creed
Toronto, Canada

In my opinion cities of 8000 inhabitants or thereabouts should be able to increase their gross income from current sales at the rate of 10 per cent per annum. We have fallen a little short of this ourselves in the past year but feel that we should have accomplished the increase at any rate.

Public Service Operating Company
N. M. Argabrite, Manager, Belvidere, Ill.

The "natural" rate of increase should be about the same as the rate of increase of population. The actual rate of increase can be made pretty nearly anything above or below this by good or bad public policy, by the character of salesmanship, etc. No definite answer can be given to this question without a knowledge of the past history of the concern. A company which for years has failed to keep pace with progress might, with normal salesmanship and policy, make rapid strides. A concern which had built up an abnormally large business for a town of its size might fail to maintain this on dropping back to a normal policy.

John C. Parker
Rochester, N. Y.

There can be no exact reply to this question, as the rate of increase would depend entirely upon what policy was pursued by the parties controlling the property. I think myself that a rate of 12 per cent to 15 per cent increase would be very fair and an increase of 20 per cent would be extra good.

H. C. Higgins
Centralia, Ill.

24—26. What steps do member companies take to secure and retain the good-will and co-operation of contractors? In other words, how do member companies deal with contractors so as to secure from them the highest degree of efficiency in securing business for both?

In power work we have secured the hearty co-operation of the contractors by the following method: We do not handle motors, and on all deals worked up by our power solicitor, all contractors are notified that the consumer is in the market for motors. On any deal worked up by a contractor he is entitled to the business and we give him all the aid we can in securing it.

N. F. Lewis
Scranton, Pa.

The level-headed electrical contractor who aims to deal fairly with his patrons, understands his trade, is ambitious to succeed and build up a profitable business, is generally willing to work in harmony with the electric company and they in turn are pleased to assist him along proper lines at any and all times.

J. H. Enright
Frederick, Md.

If you have any good prospects, that is, good ones, not those that your solicitors know they could not close and turned over as a last resort, advise at least three contractors in the neighborhood of the job.

It was suggested to the writer that he place in the office a box,

in which the contractors could place their business cards, these cards to drop through when a slide was pulled, and the contractors be advised as to the jobs as they come in, in regular order, the names of the first three cards to be taken from the bottom of the box to be used and returned to the box again, to follow in regular order.

Eugene Creed
Toronto, Canada

I do not believe too much stress can be laid on the matter of co-operation with contractors. We have an arrangement in one of our districts which, while it could not be used in all places, is to my mind an ideal arrangement. The contractor in this case is also the district contracting agent. He has an office and storeroom, in which he displays fixtures and other electrical supplies which he sells, and also electrical devices which are being introduced by the company. The rent of this office is paid by the lighting company. He receives a salary for his services plus a commission on the amount of new business written. He also gets a commission on all electrical devices he sells or places on trial. He also handles the vacuum-cleaner rental business on a similar basis. There are, in addition to this, transfers to take care of, and trouble calls and the renewing of lamps, for which he receives no remuneration but which he can well afford to do in return for the opportunities which the position gives him of getting work in his own line. The arrangement works out perfectly. His position as representative of the lighting company gives the contractor a great advantage, and the company is benefited by having a representative whose interests are to extend the business. The public are benefited because there is provided an office where they can be taken care of, whether the trouble is one for the company or the contractor to look after.

A. G. Rakestraw
Wilkinsburg, Pa.

[In Brooklyn, there are many ways in which the contractor is considered and made to feel that the central station values his good-will very highly. No motors are sold, and heating and cooking appliances are sold at cost plus contractor's or supply dealer's profit. The company does no wiring, and wiring jobs which it takes under contract, and the wiring of its own buildings, is let to contractors under competitive bids.

Cordial relations are cemented through the operation of an organization composed of contractors and Edison employees known as the "Kilowatt Club." This club meets once a month in the Edison club rooms, which, by the way, are free and open to the use of all Brooklyn contractors. These Kilowatt Club meetings furnish an opportunity for contractors and Edison men to meet on common ground at stated intervals and discuss matters of common interest. Prompt first-hand notice is given at these meetings to contractors as to changes in Edison contracts or policies, and methods of handling business are freely discussed both from the standpoint of the contractor and of the company. At least twice a year banquets or outings are given by this associa-

tion, and usually the company bears a share of the attendant expense. The Edison club rooms referred to above are equipped with pool and billiard tables, library, card tables, and all the paraphernalia of a first-class meeting hall.

Another method of co-operation is the following: If a contractor has a store with adequate windows, in a good location, the company will maintain controlled lighting of the premises, free of charge, upon the contractor painting a transparency sign on his windows which shall read, "Edison Applications Received Here." Any contractor is authorized to receive applications for service, and blanks are supplied him upon application.

Contractors were not always treated along these lines in Brooklyn, and there was at one time a very considerable feeling of ill-will toward the company on their part. During the last two years, since the change has been made, this ill-will has disappeared and is replaced by a spirit of enthusiastic and really efficient co-operation.

Every reputable contractor in Brooklyn is in reality to-day an unpaid salesman of the company.—Editor.]

24—27. What method have member companies of securing information leading to detection of theft of current?

Careful inspection by the regular inspectors, meter readers and meter testers.

William Rawson Collier
Atlanta, Ga.

We give a reward of five dollars to any employee of the company for each report leading to the discovery of theft of current either through tampering with the meter or improper connection of the wiring or any other means.

W. T. Fairbairn
Brooklyn, N. Y.

We pay a reward of five dollars to any employee who discovers and reports any lamp, motor or other current-consuming device connected ahead of a meter, or any wiring connected up in such a manner that part or all of the current used by the consumer will not be properly registered on the meter.

Rochester Railway and Light Company
Rochester, N. Y.

We have inspectors who make complete and thorough inspections of our residence and commercial districts at least once a year. These men have no regular time for calls and detect many irregularities. We have a man whose duty it is to examine our customers' accounts. If an account appears to be unusual in any way an investigation is made to determine the cause. In this way many cases have been detected only shortly after they have been put in operation. Our main difficulty comes in securing convictions. We can rarely detect a person in the act of installing a jumper or other device, and judges and juries will rarely convict on circumstantial evidence in cases of this kind.

B. W. Mendenhall
Salt Lake City, Utah

24—28. What is the proper amount of original cost which should be charged off for depreciation on a municipal electric lighting plant or any other electric lighting plant?

Generally speaking, I have never heard of a city owning a municipal electric plant whose authorities would acknowledge, when it came to the question of taxation, that they had any depreciation loss. However, judging from the history of several municipal undertakings of this character that have come under my observation within the past ten years, would say 25 per cent.

J. H. Enright
Frederick, Md.

This depends on what is meant by "depreciation." Actual depreciation may be safely charged at five per cent. There should be an interest charge of six per cent and, roughly, two to three per cent for insurance and taxes, whether the plant is municipal or private, since the tax return is lost to the municipality if money is invested in a private plant, which would otherwise go into taxable private enterprise. In the present stage of municipal accounting these would constitute practically all of the fixed costs, but under a more enlightened condition, where the maximum welfare to the community is concerned, it will be recognized, as it is by some private plant owners, that the same "velvet"—running at from five to 15 per cent—should be earned on the power plant as can be earned by the most profitable part of the enterprise capable of extension.

John C. Parker
Rochester, N. Y.

Municipal, 20 per cent; others, 15 per cent.

W. F. Wells
Brooklyn, N. Y.

[One of the fairest, most complete and comprehensive utterance on this big subject of depreciation is contained in the Decision and Order of the Railroad Commission of Wisconsin in the case of State Journal Printing Company versus Madison Gas and Electric Company, which was published in its entirety in the 1910 report of the National Electric Light Association Committee on Public Policy. This is thoroughly worth perusal and study, and is herewith recommended to the propounder of Question 24—28.—Editor.]

25—7. In what states and under what conditions has the monthly guarantee minimum charge been legally passed upon?

The Railroad Commission of Georgia has ruled that the monthly minimum charge is legal. The amount passed upon, however, is different in different parts of the state, being governed by local conditions.

William Rawson Collier
Atlanta, Ga.

On page 41 of the August-September "Bulletin," in answer to Question 25—7, the decision of the Massachusetts Gas and Electric Light Commission is not quite accurately stated.

We formerly had a charge of $1 per month per meter.

The Commission in its decison recommended in effect that hereafter we should only charge $12 per year per meter, charging $1 per month, and at the end of 12 months making a rebate so that the net result would be the same as though we had charged a minimum of $12, i. e., if a customer in some months had used more than the minimum, these amounts should be applied to reduce his minimum in the other months.

R. S. Hale
Boston, Mass.

[The same practise is now in effect in Brooklyn. The guarantee involves a minimum bill of $12 per year per meter, current used in excess of $1 during any month being credited to customer's account toward any month in same contract year, wherein $1 use is not reached. —Editor.]

NEW QUESTIONS

0—22. What system do member companies have whereby contractors are informed of the exact meter and service locations of every installation?

0—23. Please explain how to remagnetize permanent magnets from a 500-volt direct-current source.

0—24. We would like to have information or a list of the cities where ornamental posts with tungsten lamps have been installed for improvement of the business streets, together with the number of lamps utilized.

0—25. Will member companies give figures as to the period of time elapsing between acceptance of contract, and actual installation of service?

0—26. At our power station there is but one man on duty at a time, there being two shifts of twelve hours each. We have had occasions where night men went to sleep on duty. A watchman's clock would meet this condition, but we wish to protect both the man and ourselves against the possibility of his being disabled and unable to 'phone or turn in an alarm. Several hours might elapse before conditions became known, possibly losing the man his life and ruining the plant.

Required—an automatic system registering in half-hour or one-hour periods which would give an alarm either by whistle at plant or bell at distant point should the attendant not be present at the predetermined time to prevent its alarm. As the man has other duties and it might be impossible for him to be there just on the minute, such device should give him at least five minutes' warning, but should also be of such construction that he couldn't tamper with it to prevent its action for periods in advance, allowing him to cut it out entirely

for several hours. It should thus answer the purpose both of a watchman's time-detector and a safety device.

Is there such a device on the market or any station where such a method or something similar is in use?

0—27. How does the conductivity of air vary with the pressure?

1—8. This is a small town—2100. The plant, a three-wire, 110-volt, direct-current system, runs 5.00 A. M. to 12.00 midnight. 125-horse-power Corliss belted to a line shaft; this drives two 20-kilowatt, 110-volt, three-wire Edison generators with a 30-kilowatt, 220-volt Westinghouse booster. For a day load we have a Bates high-speed engine direct-connected to a 35-kilowatt Westinghouse three-wire generator.

We also run from the line shaft a 40-light No. 7 Wood arc machine. The plant is on leased ground. We desire to build a new building on an adjoining lot. The lot is 50 feet front north and south by 142 feet deep east and west. The east end of the lot fronts on the street; the west end on the alley. Our wires are now arranged so that they will come in from the east about the middle of the lot.

We think of purchasing a new 150-horse-power Corliss belted direct to a new 125-kilowatt, 250-volt generator with a balancing set, or to a pair of 62½-kilowatt, 110-volt generators. We think this outfit should be placed near the south side of the building; the generator to the east; then the engine; then the boiler toward the alley. Then we think we should move our old Corliss into this building, belt it to a 60 to 75-kilowatt machine or machines, using this for a duplicate set, then move our direct-connected set. Peak load, 650 amperes. Ordinary night load, 400 amperes. The size of the engine and generator mentioned are only approximate. We would like suggestions:

First: As to the proper size engine; also as to the proper size boilers.

Second: As to the size of building to erect so as to give us generator and engine room, boiler room and coal room. How deep should the front of the generator room be? How deep should the boiler room be, and how should the boilers be placed, east and west, or north and south? Should we put in stokers? Is there some simple and economical coal-handling apparatus? Should we arrange so that we could put in a small ice plant, three to five tons; if so, in what part of the building should this be? How high should the building be, of what construction, and what roofing material would you use?

5—6. I have been much interested in some recent articles in the press in regard to the application of thermal storage to existing boiler installations, and if all that is claimed for it is true, it offers a very efficient and comparatively inexpensive method of increasing boiler capacity. I should like to know if any of the member companies have had any experience in the use of thermal storage in connection with their boiler plants. To what extent does this increase the capacity of the boiler? Have such storage tanks been used successfully for

purifying the boiler feed as well as increasing the boiler capacity? Does the application of this system increase the general efficiency of the boilers due to more even operation? Is the priming of the boiler under overloads decreased?

7—6. Under what conditions will the step pressure of a large Curtis turbine be raised above its normal value? The turbine operates at no load at normal step pressure, but as the load grows the step pressure rises to 100 or 150 pounds above what it ought to be. The buckets and wheels are to all intents and purposes clean.

12—31. The question we asked (17—23), first published in the June issue, was not properly stated. Please put it this way:

Our system of distribution is aerial and we endeavor in the commercial districts to, as far as possible, run our lines in the lanes. These lanes are generally sixteen feet wide and it is therefore impossible for us to set the poles more than two feet out from the building line. On account of this, the fire-escapes, which frequently extend more than four feet from the front of buildings, render about half of the cross-arm on the poles useless, and the wires being close to the metal fire escapes are therefore also dangerous. Double pole construction with racks across the lanes is forbidden. The question is one entirely of distribution, illumination not entering into consideration at all. Undoubtedly these conditions have arisen in other large cities, and we would like to know what means have been used by other companies to overcome these difficulties.

12—32. What is the method employed by member companies in bringing in service from overhead lines to connect with house mains in basement or cellar? Is an extra charge made for such service in excess of that for regulation overhead service?

12—33. Should overhead wires, carrying 10,000 volts and over, be bare or insulated?

12—35. We wish to learn what satisfactory or unsatisfactory operating experience member companies have had in serving villages and farms from small transformers placed on 10,000 to 15,000 volt lines.

13—9. Is there any reliable and simple method which can be used by a cable splicer in determining whether or not a single-conductor, or multiple conductor, lead-covered cable, is carrying current which does not require removing the lead from the cable? This question refers particularly to cables carrying alternating current and the object is to prevent a cable splicer from removing the lead, or otherwise cutting into the live cable, in case the records are incorrect.

16—31. Is it worth while to use low-voltage tungsten lamps for signs, or is the improvement in high-voltage likely to make the transformer expense unjustifiable?

16—32. What is the average cost, operating and maintenance, per mean spherical candle-power of the following forms of light during the average life of the appliance? Assume oil at 10 cents per gallon; gas at $1 per M.; electric power at 10 cents per kilowatt-hour.

Kerosene oil, Rochester burner lamp.
Flat-flame Bray burner, 18 candle-power gas light.
Welsbach upright burner, 18 candle-power gas light.
Tungsten lamp, 60-watt size, 1.25 watts per candle-power.
Enclosed arc light.

16—33. We are desirous of having all the information we can get on the subject of series Mazda for street lighting. We desire to know more particularly the prices paid in localities where this form of lighting has been adopted and also would like to have some facts comparing this form of illumination with arc light illumination for residence sections.

17—27. Two lights, A and B, are 10 feet apart. The intensity of light of A at unit distance is 5, that of B at unit distance is 8. Find the point between these two lights where the illumination is a minimum.

20—68. What practise have member companies in regard to inactive meters? Are meters promptly removed or permitted to remain on the chance of securing new business, and if so, how long?

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

21—17. What companies pursue active campaigns for electric sign and outlining business, and are special rates made for this class of business?

22—31. What is a fair yearly charge per 16-candle-power lamp for suburban street lighting, the service to be multiple, 118-volt; to include all construction work, lamps, an all-night service, and controlled by a time switch. The company's lines serve the district with residence lighting.

22—32. Will member companies reply as to their policy in supplying current for lighting purposes to customers using a large amount of power current, that is, whether the lighting current is charged for at the regular power rates, or whether or not customers are allowed to use motor-generator set or static transformers for their lighting system, paying for the primary current at power rates?

22—33. Is there any company having in operation a flat-rate window-lighting agreement? If so, what is it and how does it work out?

23—17. What information can member companies give as to the ratio of disconnections to connections? i. e., what is the amount of business lost compared to the new business gained?

purifying the boiler feed as well as increasing the boiler capacity? Does the application of this system increase the general efficiency of the boilers due to more even operation? Is the priming of the boiler under overloads decreased?

7—6. Under what conditions will the step pressure of a large Curtis turbine be raised above its normal value? The turbine operates at no load at normal step pressure, but as the load grows the step pressure rises to 100 or 150 pounds above what it ought to be. The buckets and wheels are to all intents and purposes clean.

12—31. The question we asked (17—28), first published in the June issue, was not properly stated. Please put it this way:

Our system of distribution is aerial and we endeavor in the commercial districts to, as far as possible, run our lines in the lanes. These lanes are generally sixteen feet wide and it is therefore impossible for us to set the poles more than two feet out from the building line. On account of this, the fire-escapes, which frequently extend more than four feet from the front of buildings, render about half of the cross-arm on the poles useless, and the wires being close to the metal fire escapes are therefore also dangerous. Double pole construction with racks across the lanes is forbidden. The question is one entirely of distribution, illumination not entering into consideration at all. Undoubtedly these conditions have arisen in other large cities, and we would like to know what means have been used by other companies to overcome these difficulties.

12—32. What is the method employed by member companies in bringing in service from overhead lines to connect with house mains in basement or cellar? Is an extra charge made for such service in excess of that for regulation overhead service?

12—33. Should overhead wires, carrying 10,000 volts and over, be bare or insulated?

12—35. We wish to learn what satisfactory or unsatisfactory operating experience member companies have had in serving villages and farms from small transformers placed on 10,000 to 15,000 volt lines.

13—9. Is there any reliable and simple method which can be used by a cable splicer in determining whether or not a single-conductor, or multiple conductor, lead-covered cable, is carrying current which does not require removing the lead from the cable? This question refers particularly to cables carrying alternating current and the object is to prevent a cable splicer from removing the lead, or otherwise cutting into the live cable, in case the records are incorrect.

16—31. Is it worth while to use low-voltage tungsten lamps for signs, or is the improvement in high-voltage likely to make the transformer expense unjustifiable?

16—32. What is the average cost, operating and maintenance, per mean spherical candle-power of the following forms of light during the average life of the appliance? Assume oil at 10 cents per gallon; gas at $1 per M.; electric power at 10 cents per kilowatt-hour.

Kerosene oil, Rochester burner lamp.

Flat-flame Bray burner, 18 candle-power gas light.

Welsbach upright burner, 18 candle-power gas light.

Tungsten lamp, 60-watt size, 1.25 watts per candle-power.

Enclosed arc light.

16—33. We are desirous of having all the information we can get on the subject of series Mazda for street lighting. We desire to know more particularly the prices paid in localities where this form of lighting has been adopted and also would like to have some facts comparing this form of illumination with arc light illumination for residence sections.

17—27. Two lights, A and B, are 10 feet apart. The intensity of light of A at unit distance is 5, that of B at unit distance is 8. Find the point between these two lights where the illumination is a minimum.

20—68. What practise have member companies in regard to inactive meters? Are meters promptly removed or permitted to remain on the chance of securing new business, and if so, how long?

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

21—17. What companies pursue active campaigns for electric sign and outlining business, and are special rates made for this class of business?

22—31. What is a fair yearly charge per 16-candle-power lamp for suburban street lighting, the service to be multiple, 118-volt; to include all construction work, lamps, an all-night service, and controlled by a time switch. The company's lines serve the district with residence lighting.

22—32. Will member companies reply as to their policy in supplying current for lighting purposes to customers using a large amount of power current, that is, whether the lighting current is charged for at the regular power rates, or whether or not customers are allowed to use motor-generator set or static transformers for their lighting system, paying for the primary current at power rates?

22—33. Is there any company having in operation a flat-rate window-lighting agreement? If so, what is it and how does it work out?

23—17. What information can member companies give as to the ratio of disconnections to connections? i. e., what is the amount of business lost compared to the new business gained?

24—29. Would it be considered good business for a central station of 30,000-horse-power capacity, that has a heavy day load and evening peak of light and power, to take on large consumers who would use electric power between the hours of 10 P. M. and 7 A. M. at a rate equal to the cost of manufacturing current and delivering same to the consumer? It is assumed that the night load is comparatively light.

24—30. Is it policy for a central station to sell heating and cooking appliances at cost or less, or should such appliances be sold at such a profit as to make price not less than the price of same articles sold by contractors, supply houses and department stores?

24—31. Inquirer would like information from companies as to whether they attempt the right to cut off for an appliance debt. That is, if purchaser of cooking or heating appliance refuses to pay for same, do you disconnect, same as you would for a current debt?

24—32. We would like to hear from member companies as to their policy and practise in supplying breakdown connections.

24—33. (a) Is there any member company that does not bond its collectors?

(b) On what basis do member companies bond their collectors, i. e., a uniform bond for all collectors, or does bond vary in accordance with conditions of collector's territory?

(c) Do member companies pay for bonding collectors, or are collectors required to pay their own bond premiums?

(d) Do member companies in which collectors are bonded turn the cases over to bond company to settle in case of collector defaulting, or do they settle cases themselves, notwithstanding the fact that collectors are bonded?

(e) Do any member companies have their own bonding fund?

(f) What do member companies that do not have collectors bonded do if collectors should default?

(g) In last ten years how many collectors have defaulted?

25—8. Would you be kind enough to furnish us with information relative to either municipal or state laws concerning tampering with meters, fraudulently diverting current, etc., etc. We would like to get copies of such laws or enactments that have been successfully enforced. [Copies of the state laws have been forwarded to the company making this inquiry. If there are any municipal laws on this subject or any information relative to successful enforcement of either state or municipal laws, however, same will be welcomed.—Editor.]

National Electric Light Association

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***15—46.** The secondaries of three current transformers, whose primaries are in the three phases of a balanced three-phase circuit, are connected in series, or closed delta, in such a way that the electromotive force of one of them is in the same direction as that of the resultant of the other two. What current will flow in the secondary circuit, and what will be its phase relation?

15—47. What is the power-factor of the magnetizing current of the average standard line transformer, 60 cycles, 2400 volts, of from 5 to 15 kilowatts capacity? How much has the power-factor been bettered in the past ten years?

16—29. The claim is made by manufacturers that the average life of the 50-watt Gem lamp is longer by at least a third than the life of the 16-candle-power carbon lamp. Will member companies please contribute information as to whether this claim is borne out by the facts? Have members data as to the actual life of the 50-watt Gem lamp in service?

17—19. What experience have member companies had with reference to the reliability of underground series incandescent street lighting, using ornamental iron posts? Kindly furnish data and illustrations, if possible.

19—38. Do member companies experience trouble through installation of starting devices (used in connection with alternating-current motors) which require inordinately high starting current?

What regulations are in force by stations governing amount of current permitted in starting devices?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass. Let them come!

24—28. Are there any companies in cities of over 100,000 which have done away with deposits, i. e., discontinued requests for deposits, and extended credit to practically all applicants? If so, what have been the results?

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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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November 17, 1910

CONTENTS

THE PROPER CO-OPERATIVE ATTITUDE

It is always interesting to see the fundamental idea of any institution restated, not in the old terms but from a new and fresh viewpoint. In such a manner we often ascertain how firm is the faith of the fathers, or how far we may have traveled away from it, or to what extent it has been consistently developed. An example of such helpful treatment is afforded in an address delivered recently before the Section of the Public Service Company, of New Jersey, by Mr. W. K. Vanderpoel, as to the proper co-operative attitude of company employees, and taking up the subject under various heads. The three main points are the co-operative relationship between employees in the same department; between employees in different departments, and between employees and the public.

We shall be glad to forward copies of this admirable address to any other Company Sections for repetition at their meetings, but our desire here is to carry the argument a little further by noting that every proposi-

NEW MEMBERS

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Class B: New London Gas and Electric Company, New London, Conn.—Louis H. Mather, S. A. Smith.

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Edison Electric Illuminating Company, Brooklyn, N. Y.—Rudolph Batholme, F. W. Bradley, William A. Clackner, Hardy M. Cook, Frank L. Deering, Fred Dohrmann, Anthony Krause, Thomas L. Lineburgh, John Mannix, William F. Pittman, Charles Leo Tague, C. Timmerman, Wilson Y. Vedder, George J. Woodward.

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Toronto Electric Light Company, Toronto, Ont.—Stuart H. Anderson, V. R. Artois, H. S. Bedell, O. C. Brindley, James Brown, J. G. Croncher, William Davis, W. F. Dent, Hugh Gaiger, Reginald M. Harvey, C. E. Hoffman, A. H. Jackson, Fred Jarrett, Harry Lawson, H. F. Meredith, Robert A. Merritt, H. I. Millard, John Neill, James Orr, David F. Parrott, H. S. Perrott, A. Porter, T. Randall, H. Rooney, T. H. Smith, J. E. Wilcock.

The Philadelphia Electric Company, Philadelphia, Pa.—George E. Bradfield, Charles Crutchfield, Alfred Francis Del Rossi, Theodore W. Denison, Franklin R. Humphries, Harry H. Perkins, Joseph Reber.

Narragansett Electric Lighting Company, Bristol, R. I.—William Henry Angevine.

Class D: Valentine Electric Sign Co., Atlantic City, N. J.

Class E: Dearborn Drug and Chemical Works, Boston, Mass.—P. H. Hogan.

General Electric Company, New Orleans, La.—C. S. Ripley.

Excess Indicator Company, Boston, Mass.—A. T. Holbrook.

NEWS OF THE SECTIONS

A STERN NECESSITY

Returning from the St. Louis Convention, Mr. H. E. Grant presented recently before our British Columbia Electric Railway Company Section, at Vancouver, an excellent address and report on his trip, during which he made and carried home many shrewd observations and criticisms of men and things. The chief element in the address is its striking insistence on the "stern necessity" of educating the central-station employee, not only for his own good but for the welfare of the company, for "no chain is stronger than its weakest link," and each employee is a link in the chain of general efficiency. Mr. Grant is the president of the Company Technical School, whose claims he urges, but not less does he insist on the "magnificent educative possibilities" of the Company Section and "the loyal spirit of co-operation which it engenders."

Mr. Grant makes the point that a man who enters any employ enters into an agreement under which thorough and intelligent service is to be given. And then he presents this argument, which we would ask any one to weigh who might perhaps object to the broad Grant theory of employment: "May I suggest here that the employee who will not educate himself along the line of his occupation does not deserve employment, for owing to this lack he must either shirk his work, neglect the interests of the company through inattention to the requirements of its customers, or with his constant and often asinine inquiries, add to the already overburdening load of those men who know. Do not misunderstand me. I, perhaps more fully than some, realize how dependent we are on others for the knowledge which we possess; but I do believe that only those should be aided who are willing to aid themselves."

Mr. Grant mentioned in his address the fact that the company, in addition to the Technical School, was endeavoring to start a commercial course; and we can only suggest to the officers of other companies and Company Sections that it might be well to inquire further as to the doings and plans of this progressive institution out on the Coast, and take one or two leaves from its book.

A Toronto Bulletin

The Toronto Electric Light Company Section is an addition to the list of sections issuing a monthly bulletin. The first issue appeared in October, and consists of 8 pages, 12mo size, with a handsome cover on which is given the table of contents. A leading feature of the number is an excellent signed

Education," which was appreciated by all.

Messrs. Porter and Rooney related their experiences with Canada's "crack" volunteer regiment, the "Queen's Own Rifles of Canada," upon its recent participation in the army maneuvers at Aldershot, England.

Annual Meeting of the North Shore Section

The annual meeting of the North Shore Electric Company Section was held Friday evening, November 4, in the meeting room of the Commonwealth Edison Company, 139 Adams Street, Chicago. The meeting was called to order at 8.20 P.M. by Mr. PenDell, vice-chairman, with fifty members present.

Communications from the executive secretary were read relative to the adoption of Company Section badges and the terms awarding the Doherty medal. A committee, consisting of Mr. Lukes as chairman, Messrs. Cushing and Atmore, was appointed to investigate all papers that had been read at the past meetings of the branch and select one paper to be submitted in competition for the medal. A committee on badges, consisting of Mr. Schuettge, chairman, Messrs. Parshall and Dixon, was appointed to request the company officials to furnish the branch with a distinctive badge, the badges as far as possible to conform with the National Electric Light Association badge.

The annual report of the various officers and standing committees were read and approved. The secretary was requested to prepare a bulletin to be posted in all offices, stations and sub-stations, calling the attention of the non-members to the benefits to be derived from membership in the Section, and especially pointing out the extraordinary value of the 1910 Proceedings.

By unanimous vote the secretary was asked to prepare and forward to the absent chairman, Mr. John S. Reesman, resolutions extending the well wishes of the Section with the hope that he would soon be recovered in health and be able to be with the Section again.

The vice-chairman announced that the Board of Control had been appointed as a nominating committee, and the chair being temporarily occupied by Mr. Wood, the treasurer, the chairman of the nominating committee reported that the following ticket was offered: For chairman, Mr. C W. PenDell; vice-chairman, Mr. H. L. Judd; secretary, Mr. E. G. Schuettge; board of control, Mr. J. S. Reesman, Mr. A. B. Fitzgerald, Mr. Alfred Alsaker.

On motion of Mr. Hecht, duly seconded, the ballot was declared closed and the secretary was instructed to cast a ballot for the officers nominated. This being done the vice-chairman declared the gentlemen duly elected to serve for the ensuing year.

The new officers were then installed. The chairman spoke of the work for the coming year, and stated that he expected that at the next annual meeting the membership of the branch would be 212 or double what it is at present. The chairman announced that the Publication Committee had been unable to have the papers scheduled for presentation at this meeting read on account of the sickness in the family of Mr. Walsh, who was to read the paper on "Electric Vehicles." The chairman stated that he had therefore requested several of the members to prepare answers to questions in the October *Question Box,* and several interesting questions and answers were then read and discussed.

It was found that such a practice was very stimulating and helpful, a great deal of valuable information being elicited.

New Officers of British Columbia Electric Company Section

At a meeting held October 11, 1910, the following officers were elected for the year for the Section of the British Columbia Electric Railway Company, Vancouver, B. C.: Honorary president, R. H. Sperling; president, W. T. Woodroofe; vice-president, H. E. Grant; secretary-treasurer, K. B. Ryan. Executive committee: C. Rummel, L. G. Robinson, D. R. Kennedy, J. Priestman, . G. Lister.

Study of Illumination in St. Louis

The Union Electric Light and Power Company Section, St. Louis, held an interesting meeting on October 28. Mr. John Anderson illustrated by means of a lantern, the development of the steam engine from the time of its invention. Mr. T. C. Hawkins, of the Holophane Company, delivered a paper on "Distribution of Artificial Illumination" and demonstrated conclusively the advantages of the use of high-efficiency reflectors.

The meeting adjourned with several humorous and exciting moving picture films thrown upon the screen by the use of the lantern.

Officers of the Boston Edison Section

The Boston Edison Company Section, which has had a prosperous year, had its annual meeting on Tuesday, October 18, when the following officers and committees were chosen:

Officers: President, R. E. Curtis; first vice-president, James Vahey; second vice-president, John C. Redmond; secretary, E. B. Spike; treasurer, E. S. Mansfield.

To form Executive Committee: W. J. Kennedy, C. H. Ingalls.

Membership: E. S. Mansfield, chairman; E. H. Belden, S. C. Clough, W. S. Holway, B. B. Howard.

Question Box: C. H. Ingalls, chairman; G. M. W. Goettling, Chas. LeB. Kassen, T. E. Penard, F. E. Stevens.

Meetings: W. J. Kennedy, chairman; D. S. Boyden, John Campbell, C. J. Hatch, C. A. White.

Publication - Excursions: J. C. Redmond, chairman; C. H. Parker, H. W. Haskins, J. C. Norcross, C. F. Smith.

Library-Outlook: James Vahey, chairman; Daniel Goss, F. C. Hard, S. R. Keyes, W. F. Stevens.

The Best Engineering Education

The Utah Light and Railway Company Section of the National Electric Light Association resumed its meetings after a recess of three months with the first regular meeting on Wednesday evening, October 26. The meeting was well attended and thoroughly enjoyed by all present.

Mr. O. A. Honnold presented an interesting paper on "The Best Engineering Education." This was followed by addresses on the same subject by B. W. Mendenhall and W. M. Scott, chairman. After these the subject was discussed by the meeting as a whole.

The business of the evening consisted in the passing upon four amendments to the constitution which had been proposed at the last meeting. The chair appointed a committee on membership for the coming year consisting of T. P. Morgan, C. J. Jenkins, E. J. LeBlonde, J. H. Foote and B. W. Mendenhall. This committee has every indication of being a live one and hopes to be able to report a material increase in membership before the next meeting. The present membership of the Section is 44.

Commercial Engineering

A meeting of the Philadelphia Electric Company Section was held in the Assembly Room of the Company Building, 1000 Chestnut Street, Philadelphia, on October 17, President Joseph D. Israel in the chair. Four applications for membership were announced to the chairman, making the total membership 302.

Mr. John Meyer then read a paper on "Commercial Engineering." Mr. Israel requested that discussions this year should be the feature of the sessions, and stated that the object of the meetings was to bring up important questions and have a free discussion.

A most lively and interesting discussion on the paper then followed in which Messrs. Dennison, MacCreery, Lochart, Mohr, Israel, Lloyd, E. B. Green, Maxwell, Sproule, Dentley and Meyer took part. Valuable suggestions were made looking to the improvement of the work of solicitors and their training to meet the hardest kind of competition. Other points were made as to department cooperation.

A good program has been laid out ahead for several excellent meetings during the winter months, and covering a wide range of subjects.

THE DOHERTY GOLD MEDAL

In reply to a great many inquiries about the Doherty gold medal for the best paper presented before any Company Section, it is desired to call attention to the following simple conditions:

The competition is open until December 31, 1910. All papers to be submitted for award must be in the hands of the secretary of the Association not later than January 15, 1911. Any paper presented before a Section up to December 31 is eligible.

Each Company Section is to make its selection of the papers it desires to submit for the award. At the same time any member may submit his paper direct to the Medal Committee, W. C. L. Eglin, chairman, if it should not thus be selected by his Section.

As all the authors are known, it is not practical to give secret names or letters or numbers to the papers. Weight will be given by the Committee to the status or rank of the competitor, so that the humblest author will be judged equally with the highest official of a company in the contest.

It is requested that chairmen and secretaries of Sections will co-operate with the Doherty Medal Committee in securing a very general and representative competition.

All papers should be forwarded typewritten, if possible, to lessen the work of the Medal Committee in making an award.

Company Section Activity.

This is the season of the year when Company Section activity comes most into evidence, and it is desired that all secretaries will report to the Association office any and all news as to Section happenings. It is particularly desired that any elections and changes in officers of Sections should be noted.

Attention is also called to the fact that the *Proceedings* being now distributed, officers and members of Sections can acquaint themselves fully with the interesting discussion as to Section work and opportunity which took place at the St. Louis Convention. The session was very helpful and stimulating and many suggestions were brought out that will assist the various Sections to understand and develop their function, in fact, it is believed that her after no convention will go by without at least one session being devoted to a review of Section work. When it is considered that there are now 4015 Class B members, and 730 Class E, it will be seen that there is plenty of material from which to build up new Sections and to strengthen the older ones. The Section idea has got to be fully grasped by company managers and used as a splendid agency for increasing the efficiency of the force as a whole and of making each man more valuable to the Company and to himself.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y

All correspondence relating to the Question Box should be sent to the Editor at the above address.

Matter intended for publication in any particular issue must be in the hands of the Editor not later than the 28th of the preceding month.

Answers will be published as soon as received.

Since lack of time and space may make some omissions necessary, the Editor reserves the right to publish only what time and space permit, and what in his judgment is for the best interests of the Association. In general, preference will be given to questions over answers, but where it is not possible to publish answers these will be mailed to the member asking the question.

The object of the Question Box is to keep members in touch with one another's work and to do it promptly and efficiently.

Suggestions and criticisms tending to improvement are invited.

FUNCTION AND SIGNIFICANCE OF THE QUESTION BOX

When "Question Box" work was taken up by the present editor some three months ago, he felt that it might be advisable to stimulate renewed interest in this valuable feature of Association activity, and with this end in view, letters were written to a number of central station men who, it was deemed, could and would be of assistance in increasing its efficiency and making it as useful as possible to the member companies. One of the gentlemen so addressed was Mr. Henry L. Doherty. A characteristic reply was received, part of which is of such very general interest, that the liberty is taken of quoting it here as follows:

"I have just purchased a new and enlarged edition of a standard handbook. I am a great believer in the use of handbooks, and have found them very valuable in giving me ready information. When I look over any handbook it always strikes me what a wonderful amount of information it contains, in fact it seems to contain all the matter that anybody might want to know about. When, however, I go to this handbook to look up some specific problem, it seems to me I seldom find any reference to it.

"The "Question Box" idea, in a sort of form, was old prior to the time I introduced it in the Ohio Gas Light Association; but up to that time no one had ever attempted to make it a clearing-house for information and operated on a broad co-operative scale. The year I was president of the National Electric Light Association, I installed it as a feature of that Association—and I have always been anxious to see it carried to its greatest perfection, although I have not had time to give it much support during the past few years.

"My original plan was to encourage the asking for questions, if for no other reason than it should form the basis of a comprehensive handbook on the operation of electric lighting plants. The idea was

to delegate the work of revision to competent men, and to build up gradually a handbook of very great value. It was also my idea to induce every member of each organization to become a contributor of anything that he might learn which would be of value to others; and as a means of automatically indexing it, letting him make the contribution by asking a question and then answering it. While few men feel they have time to write a paper—and a great many more do not feel able to write a paper—there is no man in the business (who deserves to be in it) who should not from time to time be able to contribute some valuable piece of information to others; and up to the time of the establishment of the "Question Box," I saw no other way that these scraps of information could be contributed."

Mr. Doherty then states his intention of taking up the matter of "Question Box" work with employees in his various companies, to the end that they become contributors; and as if to show that he asks nothing from them that he is unwilling himself to do, he sends a reply which is published in this issue of the BULLETIN.

The reasons for presenting the foregoing are: First, because a conception of the value, the functions and the potentialities of the "Question Box," as set forth by the man who inaugurated it ten years ago and who to-day occupies such a commanding position in the industry, cannot fail to be of interest and to possess a special import. Second, to give those who may not have viewed it in that light a new and true idea of the meaning and significance of the "Question Box" and a realization that in contributing to it, they are taking part in an activity not only of contemporary interest, but of permanent value. Third, as a suggestion from an influential source to all who have not hitherto shared in this work, to do so, and thus help demonstrate the truth of Mr. Doherty's postulate, that "There is no man in the business (who deserves to be in it) who should not from time to time be able to contribute some valuable piece of information to others."

In this connection it may seem a little early in the game, but the present editor is so grateful to the many who have promptly responded to his call and given freely of their busy time and valuable knowledge, that he cannot resist using this opportunity to express his thanks and appreciation, and to voice an earnest hope for such a continuance and increase in this co-operation as will result in rendering the "Question Box" as it should be, a clearing-house of opportune ideas, and a royal road to reliable information concerning central-station operation, practise and policies.

ANSWERS

O—21. This inquirer seeks information as to the cities wherein permits are required from city authorities before overhead or under-

ground service may be installed and as to how long it takes to secure such permits?

The city authorities of Rochester require that we secure permits from the Commissioner of Public Works before installing either overhead or underground services. We make application to the Commissioner by letter, attaching blue prints showing location, etc., and permit is granted us immediately. The only requirements of the city authorities are that the party making application for permits shall be responsible and reliable, and if the company is known to be such there is no difficulty whatever in getting these permits promptly.

T. H. Christie
Rochester, N. Y.

This company is required to file application with the city authorities for permission to install overhead and underground services. The time between application and receipt of permits for different types of applications is approximately as follows:

Overhead services involving installation of transformers or pole —four days.

Overhead service involving connection of service cable to secondary mains—two days.

Underground service involving construction of manhole or mains —three days.

Underground service involving extension of 100 feet or more— five days.

Overhead service involving pole line extension—one week.

These are averages under favorable conditions. There are times when to secure permits takes much longer.

W. T. Fairbairn
Brooklyn, N. Y.

Permits can be secured from the city authorities for installing underground services usually on the same day that the application is made.

Overhead services require no permit from the city authorities where it is only necessary to string wire from one pole to the building, but where necessary to extend our lines for several poles in order to reach the customer a "string wire permit" is required, which is usually issued inside of two days from the time of application.

B. E. Strohm, General Foreman
Underground Department, Commonwealth Edison Co.
Chicago, Ill.

O—22. What system do member companies have whereby contractors are informed of the exact meter and service locations of every installation?

We supply all contractors with forms (No. 1), and this form is mailed to the engineering department who in turn refer it to the

service department, and they send a right-of-way man out and he locates the service. This information is then given to inspector and

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APPLICATION FOR LOCATION OF SERVICE AND METER.

Date Nov. 1st, 1910

The Philadelphia Electric Co.,
10th & Chestnut Sts., Philadelphia.

Kindly furnish us with location of the service and meter for

Name John Jones

Address 3125 No. Broad St.

Connected load will be 25-16 c. p. lamps

Yours very truly,

Geo. J. Rapp

Kindly mail to Engineering Dept., 1000 Chestnut St.

Address 714 No. 27th St.

NOTE—Enter under "Connected Load" the number of incandescent lamps, arc lamps, etc., and number of motors and H. P. of motors.

Answered Nov. 3rd 1910 By G. H.

SIZE OF FORM 5" x 8"

he locates meter. The service and meter location is then turned over to the office and the contractor notified by mail, using form No. 2.

George H. Hartman, Jr.
Philadelphia, Pa.

We notify all contractors that unless some special permission is given them, the meter must be placed on the back porch out of the weather, and the service wires must come out the front of the building at a point nearest to our lines.

Thomas W. Peters
Columbus, Ga.

We have one man whose business it is to locate for the contractor, the service cut-in in each case. The contractor is then required to wire to this location. We do not designate exact meter locations, but require meter loop to be placed as near cut-in as possible and in dry place convenient for reading and testing.

William Rawson Collier
Atlanta, Ga.

Local contractors are furnished periodically with printed instructions as to our service and meter rules. It is generally understood that all service connections shall be made to the rear of buildings and that meters shall be placed within four feet of service entrance unless wiring for greater distances is done in conduit. If it is not practicable to make such a rear entrance point our representative meets the contractor on the premises and they agree on a suitable point of entrance.

S. M. Sheridan
Detroit, Mich.

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THE PHILADELPHIA ELECTRIC CO.
Tenth & Chestnut Streets

Philadelphia, Nov. 3rd. 1910

Engineering Department

To Geo. J. Rapp

714 No. 27th St.

In answer to your request for location of service and meter for

Name John Jones

Address 3125 No. Broad St.

please note the following:

Service will be terminated on rear wall 2 feet from North wall on line with top of 2d story windows.

Condulet to be terminated above this point.

Meter will be erected on Rear cellar wall near North wall within 6 feet from the floor

Yours very truly,

THE PHILADELPHIA ELECTRIC CO.

By G. H.

Size of Form $8\frac{1}{4}$" x $10\frac{3}{4}$"

Philadelphia Answer 0—22

(See Page 131)

In Rochester the electric contractors upon starting a wiring job make one report of the job to the Board of Fire Underwriters and one to the company. On receipt of the report, one of the company's inspectors goes to the job and locates the service, meter cabinet and meter location. He also makes an inspection, and gives information from time to time until the job is completed, then upon the approval of the Board of Fire Underwriters orders service run and meter installed. He can also be called on to give location to the contractor at the time the job is being figured. This is done by 'phone conversation with the inspector, who afterwards calls up the contractor and gives him the approximate location.

L. W. Layman
Rochester, N. Y.

We issue a circular letter to all electrical contractors, builders and architects stating that the meter should always be installed

No.________

Roanoke, Va.,_________________191__

ROANOKE RY. & ELEC. CO.
ROANOKE, VA.

Received __________
Referred to __________
Answered __________

Gentlemen:

CONTRACTOR'S ADVICE AND INQUIRY.

We are undertaking the following installation. Please furnish necessary data regarding location of service, meter and kind of current.

Name	Address	Date
____ Inc. Lamps ____ c. p.	____ Motor ____ H. P. ____ Volt	Heat Rad. ____
____ Arc " ____ Amp.		Additional ____
____ " ____ Amp.		Temporary ____

Remarks________________________________

________________ Signed________________ by________

No.________ ROANOKE, VA.,________________191__

ROANOKE RAILWAY AND ELECTRIC CO.
INSPECTION DEPARTMENT

To________________________________

Address________________________________

We beg to advise regarding service as per your postal dated __________ 191__

Name	Address

Location of Service________________________________

Kind of Service ______ Wire ______ Current ______ Volts______ Phase______

Type of Meter ________________ Location of Meter Loop________________

Remarks ________________________________

Refer to ________ Approved ________ Sgd. ________________ Elec. Engr.

ANSWER 0—22. SIZE $5\frac{1}{2}$ in. BY $3\frac{1}{4}$.

on the lower rear porch of residence, unless special conditions do not permit, in which case they will confer with us and we will give them the location.

We also issue to all contractors an advice and inquiry card,

in the form of a postal, which is mailed to us whenever any information is wanted.

W. G. Claytor
Roanoke, Va.

0—24. We would like to have information or a list of the cities where ornamental posts with tungsten lamps have been installed for improvement of the business streets, together with the number of lamps utilized.

The last few issues of the "Illuminating Engineer" have had complete descriptions of a large number of ornamental street lighting installations.

A. G. Rakestraw
Wilkinsburg, Pa.

The General Electric Company has issued a booklet entitled, "Ornamental Street Lighting With Tungsten Lamps," which goes quite thoroughly into this matter and gives a list of the cities where such lighting has been introduced.

The Rochester Railway and Light Company has installed ornamental posts carrying Mazda lamps in some of the parks and residential streets. In most cases a concrete post is used, fitted with a cast iron top, holding a 250-watt, 7½ amperes series Mazda lamp, with 12-inch opalescent globe. Our company is now negotiating with the property owners on one of the principal business streets for the illumination of the street by means of tungsten lamps. It is proposed to install ornamental iron posts each carrying five 100-watt Mazda lamps.

J. O. Montignani
Rochester, N. Y.

We recently installed 85 tungsten standards in a business street. Each standard contains five 60-watt tungsten lamps. The standards are placed about 100 feet apart. These standards were purchased by the merchants in the street and were presented by them to the city of Buffalo, the city agreeing to illuminate them.

Buffalo General Electric Company
Buffalo, N. Y.

Atlanta is now installing a system of ornamental posts for street lighting. There will be one hundred and twenty-five posts, placed on both sides of the street, approximately seventy feet apart, on the property lines at each corner. The ornamental post selected in Atlanta is fourteen feet in height and carries five one 100-watt tungsten lamps in opal balls.

William Rawson Collier
Atlanta, Ga.

0—25. Will member companies give figures as to the period of time elapsing between acceptance of contract, and actual installation of service?

If there is no cut in to be run, we set the meter the same day that the contract is secured, provided the order is turned in to the office

before 5 o'clock P. M. If after 5 P. M., it is done the first thing the next morning. If connection is to be made from the street and not more than one pole is to be set, we give the customer service in twenty-four hours from the time the contract is turned into the office. We believe in giving the customer service as soon as possible after he applies for it, therefore all our efforts are turned in this direction and this accounts for the short time which elapses between the time the contract is signed and the meter is set.

Thomas W. Peters
Columbus, Ga.

In Atlanta this depends to a great extent upon whether or not the city electrician has furnished the company with an approval on the wiring. If such an approval has been furnished, the actual installation of service is generally made within forty-eight hours after the application has been accepted, and the deposit, if one is asked, has been made.

William Rawson Collier
Atlanta, Ga.

Providing that the wiring has been passed by the inspector, the time elapsing between acceptance of contract, and actual installation of service from September 1 to March 1, is about five days, and during the remainder of the year about three days.

R. Manser
Toronto, Canada.

On premises where service has already been established, we install meter and lamps within twenty-four hours of the placing of the order. If a service loop is required, service is established within forty-eight hours. We do not undertake to furnish service where extensions to our pole lines are necessary on any schedule of time.

S. M. Sheridan
Detroit, Mich.

This depends on several things. Where an inspection is required by the Bureau of Electricity as in the case of a new house or one that has not had current used in it recently, the time is about three or four days. If we have to get permission to set a pole or do underground work, it may be a week or more. In other cases we can and frequently do make connection in 24 hours and we have in case of emergency, connected a house in one hour from the time that the request was 'phoned to the office.

A. G. Rakestraw
Wilkinsburg, Pa.

Ordinary service connections either overhead or underground are usually installed within one week from date of acceptance of contract. In special cases where service is required immediately it can be installed inside of two days.

B. E. Strohm
Chicago, Ill.

The time varies entirely with conditions. Often with a hurry up job, we install service the same day we accept the contract, but as a rule from a week to ten days elapses. **W. R. Putnam**

Marinette, Wis.

Meter is set and service ready on any contract accepted on our lines in one-half day where service wires are connected to house, and in one day when it is necessary to run aerial service.

Norman B. Hickox

Muskogee, Okla.

O—27. How does the conductivity of air vary with the pressure?

Pure air is a mechanical mixture of the gases oxygen and nitrogen, but under different conditions of temperature and location, it contains various other substances as carbon, other mineral substances, and moisture.

The dielectric strength of air would depend mainly on the composition; pure dry air having a greater dielectric strength than moist air containing mineral substances. Air under pressure would have a slightly less dielectric strength due to the more condensed condition of the mineral substances and moisture.

The air would in no two cases be identical in composition so that any law giving the relation of the dielectric strength under varying pressures, would be correct only for one particular time and condition. **K. W. Alger**

Chicago, Ill.

5—6. I have been much interested in some recent articles in the press in regard to the application of thermal storage to existing boiler installations, and if all that is claimed for it is true, it offers a very efficient and comparatively inexpensive method of increasing boiler capacity. I should like to know if any of the member companies have had any experience in the use of thermal storage in connection with their boiler plants. To what extent does this increase the capacity of the boiler? Have such storage tanks been used successfully for purifying the boiler feed as well as increasing the boiler capacity? Does the application of this system increase the general efficiency of the boilers due to more even operation? Is the priming of the boiler under overloads decreased?

Whilst the company with which I am connected has installed no thermal storage tanks, in connection with the boilers, I have looked into the system as it is applied in Europe, more especially in England. From a purely thermodynamic point of view there can be no gain whatever from thermal storage, the only gain in efficiency being due to the fact that the boiler tends to operate slightly more economically with the higher temperature feed water and, of course, gives out very considerably increased output with the hotter water. There is, also, a tendency to throw down some of the sulphates in the water, in the

shape of carbonates in the thermal storage tanks, and so get the benefit of cleaner boilers.

The other side of the question involves the dangers due to having an enormous quantity of water under boiler pressure and at boiler temperatures, and the possibility of water hammer destroying the tanks. This has happened on several different occasions in England, with most disastrous results. This danger is such a grave one and the possible saving due to thermal storage is so small, I should hesitate to recommend it.

A much better proposition from every point of view, in my opinion, is the installation of very large capacity economizers. This gives thermal storage in its best form; namely, in tubes of comparatively small diameter, which are getting their heat from the waste gases after they leave the boilers. The collapse of a tube in the economizer is a comparatively harmless matter; whereas it can be readily seen that the collapse of a tank five or six feet in diameter, and from 20 to 30 feet long, is a very serious matter when full of water at the temperature and pressure of the steam and water.

I am not aware that any installation of tanks for thermal storage has been made in the United States.

H. G. Stott,
Superintendent Motive Power,
Interborough Rapid Transit Company
New York City.

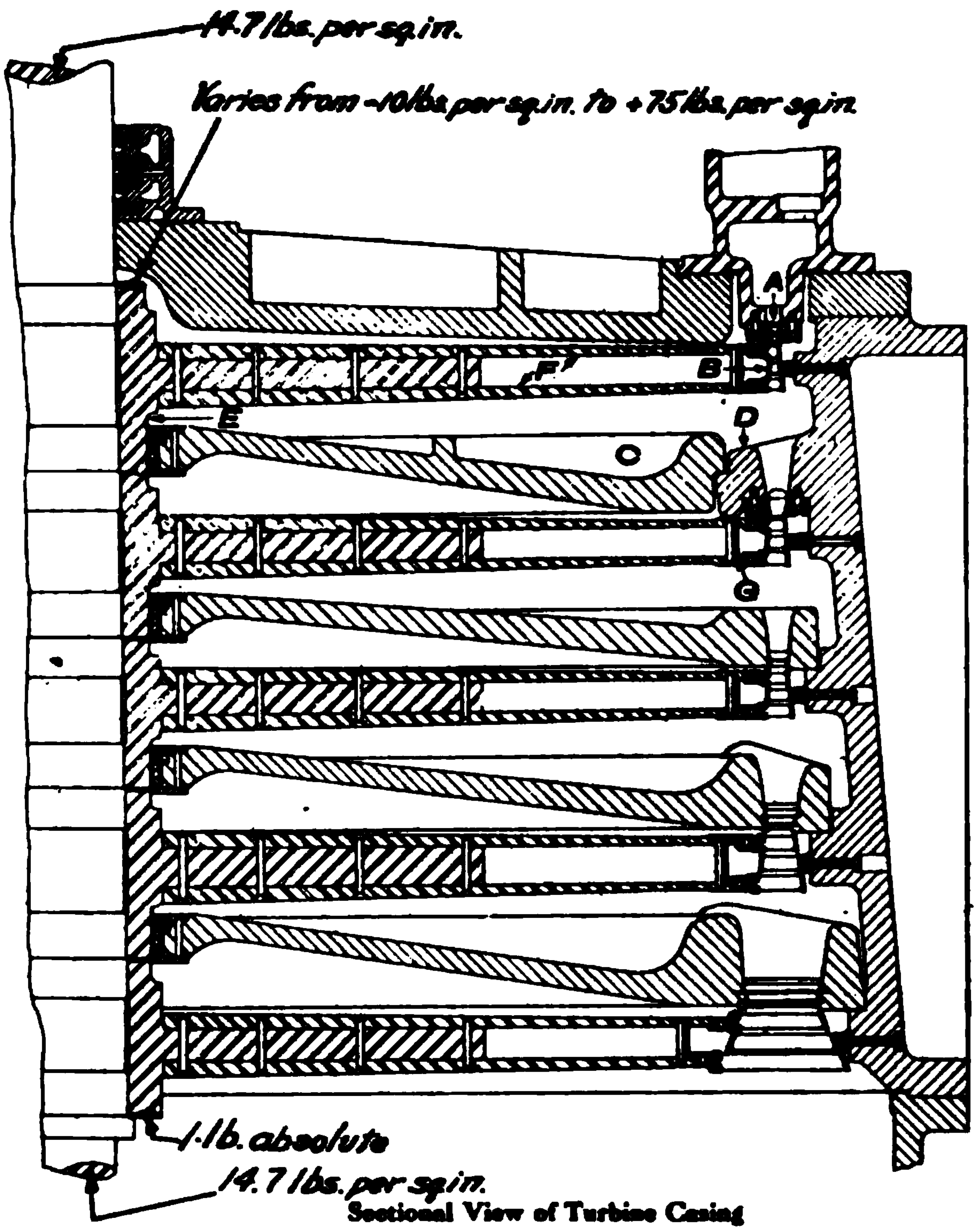
7—6. Under what conditions will the step pressure of a large Curtis turbine be raised above its normal value? The turbine operates at no load at normal step pressure, but as the load grows the step pressure rises to 100 or 150 pounds above what it ought to be. The buckets and wheels are to all intents and purposes clean.

The reason why the step pressure increases from no load to full load and overload is due to the fact that the carbon packing in the first stage diaphragm does not run on the shaft but on the wheel hub, which is, of course, a great deal larger than the shaft and consequently at no load there is a partial vacuum in the first stage, there being an actual lifting force which equals the area of the hub times the pounds pressure absolute below the atmosphere. As the load increases, the pressure on this area is increased and in some of our vertical machines goes up to about 75 pounds. The amount of increase of step pressure varies in different machines in direct relation to the weight of the rotor and the amount of this unbalanced area. An increase of 100 to 150 pounds seems excessive as the increase in most of our machines is generally less than half that. If the turbine to which this question refers was known to us it would be a simple question to calculate just what this increase of pressure should be.

Herewith, is a cut from a cross-section of one of our vertical

turbines and from this and from the above I think it will be understood why the pressure will increase with load.

Eskil Berg
Schenectady, N. Y.



Sectional View of Turbine Casing

ANSWER 7—6.

The step pressure of a Curtis turbine depends primarily upon the dead weight of the revolving element, composed of field, wheels, and shaft. In addition, a downward thrust has to be cared for, due to the difference in steam pressure between the first and last stage steam chests acting on a small annular area. This area is determined, roughly, by the diameter of the shaft and the inside diameter of the diaphragm packing. As the difference in pressure increases with the load, the downward thrust does so, also. Its value always remains small compared with the dead weight of the revolving element. It is harmless, the increase not being sufficient to affect the step design in any way. The variation itself is taken care of automatically by the oil baffler in series with the step bearing.

In Curtis turbines of horizontal design the relative location of shaft and packing rings is intentionally different; the small end

thrust mentioned above disappears, and the machine is left without appreciable end thrust of any kind.

A variation at the thrust block of from 100 to 150 pounds, as mentioned in the question, is extreme. It is only in plants operating with the highest pump pressures, of the order of 1200 pounds, that such a variation would be even approximated. With lower pump pressures, such a variation would indicate internal trouble, such as, possibly, buckets bent over by some foreign body passing through.

Incidentally, there is not any appreciable end thrust introduced by the passage of the steam through the buckets of a Curtis tubine. The buckets of the Curtis turbine are so shaped that the steam passes through them without end thrust.

H. H. Barnes, Jr.
New York

The above conditions occur very frequently in all large turbines —both vertical and horizontal—and is caused by the balance. In the Curtis turbine as the load increases the thrust of the steam striking against the revolving diaphragms becomes greater, consequently, the step pressure must be increased to maintain the rotating parts of the turbine in the same position.

H. P. Wood
Brooklyn, N. Y.

11—11. What kind of an instrument is recommended for locating grounds, crosses, broken wires, et cetera, on a 15-mile, 3-phase, 11,000-volt line? We had a wire down on frozen ground recently and it did not show up on the ground detector, but gave us considerable trouble to locate as it had the appearance of transformer trouble; and we, therefore, did not look for a broken wire.

On our 11,000 and 16,500 volt transmission lines we use a short circuiting device for testing for open circuits. The section on which we are then having trouble is cut out and a small chain is thrown over the line at one end of the section. Suitable current is then put on at the other end and each pair of wires tested for an open. Current can be furnished by a set of ringers if other current is not available. This will show up an open, and if the transpositions are known, it will indicate the wire which the open is on.

In cases of trouble like that referred to, the first thing we do is to test the apparatus in the station by opening up the disconnecting switches which lead to the transmission line. This indicates at once whether the trouble is inside or outside the station.

C. L. Cadle
Rochester, N. Y.

11—14. What are the limiting conditions governing the opening of an arc under oil as to pressure set up in the cylinder, temperature of oil, et cetera?

All other conditions being the same, both the temperature and the pressure in the switch cylinder are functions of the amount of

current in the arc and the length of time the arc holds. The pressure resulting is due first to the formation of gases from the breaking up of the oil and the vaporization of the metal terminals, and second from the expansion of the oil due to the temperature.

In all except the most extraordinary cases, the length of time an arc will hold under oil is exceedingly small, and the resulting rise in temperature very slight. If the switch is closed and opened rapidly with a given current, the rise in temperature which will result will of course be due to the amount of heat necessary to be dissipated in the switch, and this again will depend very largely on the amount of oil used in the switch, providing for temporary heat storage, and the general surroundings of the switch with reference to its ability to radiate this heat to the atmosphere. The extreme of both temperature and pressure can probably be best reached by confining a heavy arc in a small cylinder, with little air space above the oil to act as a cushion, and making no provision for the escape of air or gas.

We carried out some experiments some time ago to determine this point, the conditions purposely being made as severe as possible. A small steel cylinder containing a switch which was arranged to open a short-circuit on a large power house was further provided with a steam engine indicator to get the instantaneous values of the pressure when the switch was opened. The conditions for both temperature and pressure were far more severe than are found in ordinary service, and under these conditions the maximum rise in pressure (which was practically instantaneous, immediately falling to a lower value) was approximately 35 pounds per square inch.

A secondary effect which is possible in the case of oil switches is the formation of explosive mixtures of gas and air in the air space above the switch; even when such explosive mixtures are present, there is little or no danger of their being exploded unless through some accident an arc or spark is formed in this gas, since oil will not take fire even when it reaches the flashing temperature, so long as the arc is confined underneath the oil. Theoretically the pressure resulting from an explosion due to the formation of gaseous mixtures with air, even though the whole available space is occupied by the explosive mixture, and assuming that there are no vents to relieve the pressure in case of explosion, would not be more than approximately fifty pounds per square inch in the most extreme conditions.

In the above I have referred to conditions which should be considered as extreme, and probably not possible except under accidental conditions of operation. In all normal operation of well-designed switches, the limits of pressure and temperature in a switch cylinder will be very low, even under very heavy service conditions.

H. P. Davis, Assistant to First Vice-President
Westinghouse Electric and Manufacturing Company
Pittsburg, Pa.

11—16. (a) What steps have been taken for predetermining break-downs of high-tension cables? (b) What has been done for isolating such breaks?

(a) Regular insulation tests at stated intervals are made to show the comparative condition of the cables as regards insulation over certain definite periods. A reduction in the insulation resistance of the cable is sufficient cause for investigation as to its condition. In many cases, this has resulted in locating a semi-defective piece of cable before the actual breakdown has taken place. It occasionally happens that a cable becomes grounded while in service, in which case it is immediately cut out of service and repaired. These troubles are usually indicated in advance by the action of the ground detectors, which are generally in use in all stations, usually permitting a sufficient time to locate the cable in trouble before the actual breakdown takes place. The Torchio device for indicating cables which are faulty is also used to some extent and with good success.

(b) The usual methods of protecting cables in manholes by wrapping with asbestos and steel tapes, protecting with split duct, and other similar methods of construction, have all been employed for the purpose of preventing the spread of cable trouble when a break occurs in the underground conduit system.

L. L. Elden
Boston, Mass.

12—29. Are any public service corporations using 11,000-volt overhead wires on business and residential streets?

The sanitary district has 12,000-volt, 60-cycle overhead circuits on several streets in Chicago.

V. H. Julian
Chicago, Ill.

We have an 11,000-volt overhead line through the residental section of the nearby town to which we supply current.

W. G. Claytor
Roanoke, Va.

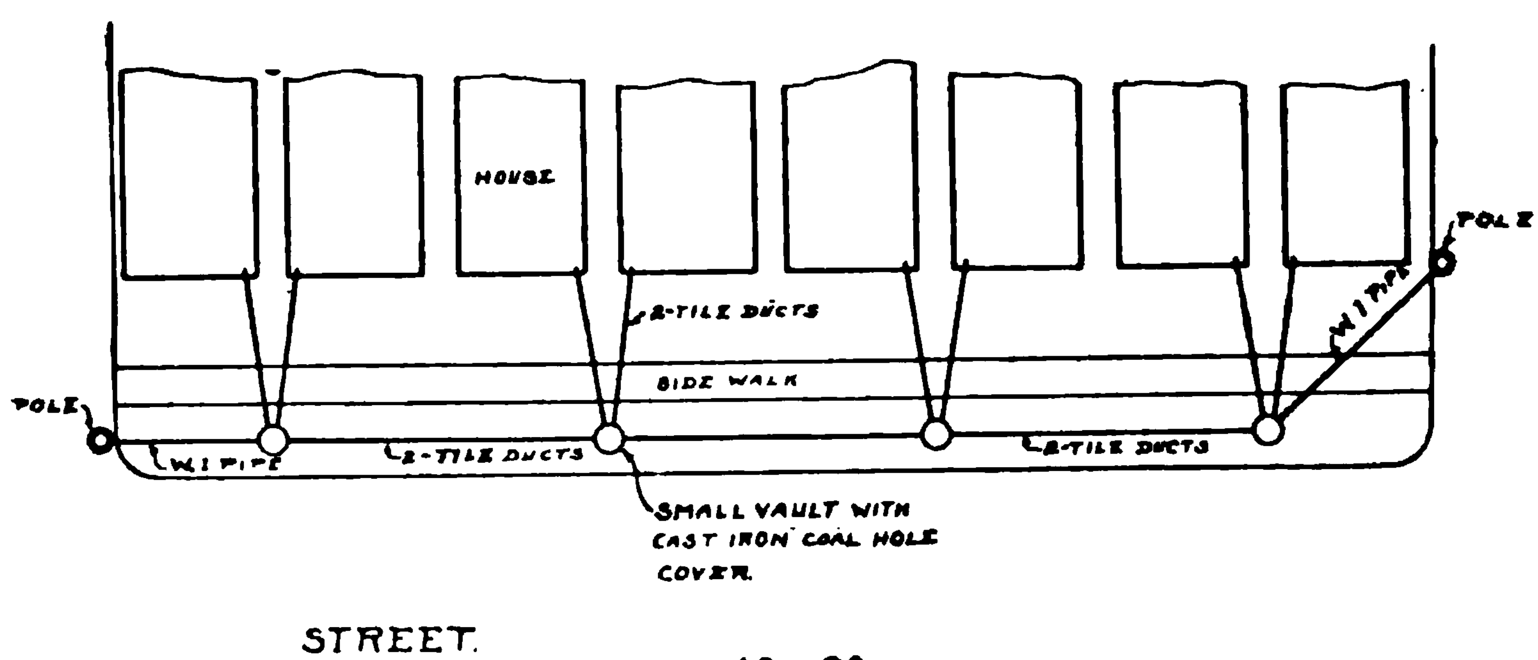
12—30. One of our citizens owns eight lots, 25 feet frontage, comprising the whole frontage of one block, which is 200 feet long between property lines. This owner wishes to build eight houses, to be supplied with electric current (alternating) and telephones, but wants no poles or wires on the property. He thinks that an overhead-underground service might be arranged for the block by having one pole at each end of the block from which the wires could be carried down to some sort of a hollow curbstone, which would serve as a conduit and from which services, electric light and telephone, could be carried underground into the cellars of the houses. He thinks a hollow curb could be made of cement with removable iron cover. I would like to know whether or not any similar case has been worked out, and how, and would welcome suggestions.

I find that we have a similar situation in Chicago. Mr. Bennet's sub-division along Euclid Avenue between 67th and 71st Streets was planned with an idea of having no poles either in the streets or in the alley. The company laid out the sub-division, installing a conduit system at their own expense in the street, with manholes every block large enough to accommodate transformers and hand-holes at every lot line with a lateral feeding underground into each lot. In this way the city arc lighting circuit, telephone company's cables and our primary, secondary and transformer equipment were all placed underground, we having installed the cables and transformers at our own expense. The idea of having underground conduit built in the curbstone could not be entertained if the manhole covers were to be outside of the curb line or in the gutter as in that case all the water draining from the street would run directly into the manholes and cause considerable damage to equipment such as transformers or fuse boxes. The system, in case it entailed two lines of conduit, one on each side of the street, would be less economical from the electric lighting company's point of view, as it would be necessary to install two secondary distribution mains and two transformers instead of one. The best scheme therefore, from an economical point of view, would be to have only one duct line and distribute to both sides of the street from this line.

W. G. Kelley
Chicago, Ill.

The use of a hollow curbstone to take the place of conduit is not practical. The cost of such a curbstone would be in excess of a conduit system, and would also be continually exposed and liable to damage by vehicles on the street, and further, the openings which would have to be made in it for the purpose of service taps would probably always be full of water which would be a source of trouble where the service taps were made.

I would suggest a conduit system in accordance with the accompanying sketch which would consist of two tile ducts laid in the



ANSWER 12—30.

grass plot between the curb and the sidewalk with small vaults built at the dividing lines of two houses, with two tile ducts extending from the vault to each house. In this manner it would require but four vaults for the eight service connections. The connection to the conduit system might be made with wrought iron pipe extending from one of the vaults at the end of the block, to and up the pole.

B. E. Strohm, General Foreman
Underground Department, Commonwealth Edison Co.
Chicago, Ill.

The cheapest form of supplying the underground service desired should be a line of conduit run through where the back yards will be with a pull-box opposite each house from which necessary taps could be made. If the eight houses adjoin, it might be easier to run straight through the several cellars, with pull-boxes in each cellar. By running conduit up pole to 10 feet above ground, both aerial telephone and electric wires can be connected. Lead-covered cable should be used in conduit. **Norman B. Hickox**
Muskogee, Okla.

12—31. The question we asked (17—23), first published in the June issue, was not properly stated. Please put it this way:

Our system of distribution is aerial and we endeavor in the commercial districts to, as far as possible, run our lines in the lanes. These lanes are generally sixteen feet wide and it is therefore impossible for us to set the poles more than two feet out from the building line. On account of this, the fire-escapes, which frequently extend more than four feet from the front of buildings, render about half of the cross-arm on the poles useless, and the wires being close to the metal fire-escapes are therefore also dangerous...Double pole construction with racks across the lanes is forbidden. The question is one entirely of distribution, illumination not entering into consideration at all. Undoubtedly these conditions have arisen in other large cities, and we would like to know what means have been used by other companies to overcome these difficulties.

If distribution is at low-voltage the wires might well be carried in metal conduits fastened to the buildings, with services taken off at necessary points by condulets.

If distribution is at high-voltage the use of high-tension lead-covered cables in metal conduit attached to the walls might be used. The transformers for serving each block could be mounted on pole in lane and low-tension distribution to customers made through metal conduits fastened to wall.

Would not the business warrant regular underground construction with subway type transformers?

William Rawson Collier
Atlanta, Ga.

12—32. What is the method employed by member companies in bringing in service from overhead lines to connect with house mains in basement or cellar? Is an extra charge made for such service in excess of that for regulation overhead service?

In certain business sections of the city where this company maintains overhead lines only, it is the practice to bring the service into the customer's premises overhead, that is to say, the service would be brought in on the store floor and if the house mains terminate in cellar or basement, it would be incumbent upon the customer to extend the house mains to the point of entrance of the service upstairs. In cases of this kind, the meter is set either in the cellar or at the point of entrance of service as the customer desires. If the customer desires that service be brought into basement or cellar and connected to house mains at that point a standpipe service is installed provided the customer agrees to pay the charges in excess of the regulation overhead service.

The following method is employed in installing standpipe service: On small installations a three-conductor service cable is run from pole to building and is attached to the building about 20 feet from the ground and an iron pipe is fastened to the building extending down into the cellar or basement. Three lead armored conductors are pulled in through the standpipe and connected to the service cable on the front of building. In some cases standpipe services are brought down the pole and into the building (if pole is in front of premises) but poles are not always available and the standpipe must be attached to the building.

If the customer objects to the standpipe on the building and agrees to pay for an overhead-underground service, the following method is employed: An iron standpipe is fastened to the pole nearest to the premises and extends down thence along the street to a manhole set in the street in front of the premises. A service pipe is then installed extending from the manhole in the street into the cellar of the building to a point inside of the house line. Three lead armored cables are pulled through the standpipe from the secondary side of the transformers on the pole to the manhole and jointed to three lead armored conductors extending through the service pipe to the customer's premises.

In the outlying residential sections in the overhead area where nearly all houses are detached or semi-detached the practise of installing overhead service is as follows: In cases where the house main terminates in the upper story in a room in the front or side of the house, the service is brought into the building at a point where house mains terminate or as near to it as possible in the upper part of the house.

In cases where house mains terminate in the basement or cellar of a house, a three-conductor cable extends from the pole and is attached to the building at a point approximately 20-25 feet above the

ground and continues in Greenfield flexible tubing down the front or side of the house to a point approximately three or four feet above the surface of the ground, where it is brought into the cellar or basement where the house mains terminate. No extra charge is made for this latter type of construction.

W. T. Fairbairn
Brooklyn, N. Y.

The customer is required to wire from the cellar to the overhead cut-in location in conduit and to bring out the wires so that the company can make connection to them.

William Rawson Collier
Atlanta, Ga.

Service from overhead lines is carried to the building free of charge, but from point of contact a stand-pipe is carried down the wall to cellar and a charge is made to cover erection of stand-pipe, and the necessary connections inside of building, which become the property of the consumer.

R. Manser
Toronto, Canada.

In such cases, we require a customer to install, at his own expense, an iron conduit from the cellar, and under the sidewalk, to our nearest pole, and 15 feet up the pole, and draw the cable in complete, to which we connect free as in overhead connections. If desired, we will put in the cable and conduit at cost. If the transformer is to be located in the cellar, customer must also provide grounded cage.

A. G. Rakestraw
Wilkinsburg, Pa.

If customer desires service brought into his basement from overhead lines, it is usually considered part of the interior wiring contractor's work to bring the service wires out of the basement through an iron conduit up alongside of the wall to the second floor, the overhead service being brought from the pole to this service outlet.

B. E. Strohm
Chicago, Ill.

We charge for conduit used in carrying overhead service to the cellar. We make no charge for service entering overhead.

W. R. Putnam
Marinette, Wis.

Services run underground must be put in by the electrical contractor at the expense of the property owner, and the conduit run up our nearest pole to a point ten feet above ground, finishing up with a type "F" condulet. We then connect aerial services to wires brought out of condulet.

Norman B. Hickox
Muskogee, Okla.

Where customer has his house mains in the basement the company requires him to bring his entrance wires up the side of the building for not less than 12 feet in conduit.

J. M. Fried
Poughkeepsie, N. Y.

12—88. Should overhead wires, carrying 10,000 volts and over, be bare or insulated?

I consider it safer to have overhead wires, of 10,000 volts and over, bare and not insulated, for the following reason: At these voltages, it is practically impossible to put an insulation on the wire, at reasonable cost, which when exposed to the weather would not become unsafe, and the use of insulation then is a source of danger, as it gives a false sense of safety, the more as the usual protection by rubber gloves, etc., is no longer reliable at such high voltages. Thus, such overhead circuits should either be bare, and then must not be touched when alive, or lead armored cable with grounded armor should be used, which latter is usually excluded by its cost.

Charles P. Steinmetz
Schenectady, N. Y.

In my opinion, it is unnecessary to insulate overhead wires carrying the voltages of 10,000 volts and over. Such insulation adds greatly to the cost of the wire, increases its diameter, thereby causing increased strains due to wind, sleet, etc., and after a few months' service not only ceases to be of any value but actually becomes an added danger. Wiremen and others see the cables insulated and feel that they are safe to handle, whereas, weather cracks and other defects frequently exist in the insulation, which makes contact dangerous.

I should recommend very strongly against the adoption of any such practice, except in very special cases. I know of certain locations where high voltage wires pass under foot bridges and elsewhere where there is possibility of contact. Through such short distances the transmission company can afford to put on such thick insulation that it really is a protection, which of course would be prohibitive in cost for any great length of wire.

H. W. Buck
New York.

All of our overhead wires carrying 10,000 volts and over are bare, as the ordinary weather proof insulation would practically be of no service should the wires come into contact with each other or the ground. By using bare wire we have that much less weight to support.

W. G. Claytor
Roanoke, Va.

12—85. We wish to learn what satisfactory or unsatisfactory operating experience member companies have had in serving villages and farms from small transformers placed on 10,000 to 15,000-volt lines.

While we distribute the bulk of our current in comparatively small towns and farming districts, we use a lower distributing voltage, namely, 6600 for the outlying districts and 2200 in the towns. I may say that we have no trouble whatever with 6600-volt lines and should not expect any trouble from a 10,000-volt line operating under the same conditions. The controlling factor in a case of this kind would be the practicability and cost of the transformer, for, in a farming community, the bulk of the power is sold in very small units, widely separated.

John Coffee Hays, President and General Manager
Mt. Whitney Power and Electric Company
Visalia, California.

I know of no companies in the northwest that are delivering current to individual consumers from small transformers at from 10,000 to 15,000 volts. Our company steps down from 60,000 to 13,000 outside of the city limits and enters our sub-station within the city limits at 13,000 and distributes at this voltage to sub-stations of considerable size.

Some eight years ago I was employed by the Pacific Light and Power Company of Los Angeles, California, and they step down to small villages and pumping plants from the pole transformers at 11,000 to 440 volts, which, at the time, I considered quite successful.

M. C. Osborn
Spokane, Washington.

The experience of the La Porte Electric Company in serving small villages and farmers from a 6600-volt line has been most satisfactory.

J. H. Harding, President
La Porte, Ind.

We have a 10,000-volt high-tension line running through the country about twelve miles supplying current to another town. We have two small transformers on this line, which have given us considerable trouble. We have decided not to install any more unless they are of large enough size to permit the use of a sub-station.

W. G. Claytor
Roanoke, Va.

Have served a village with a 30-kilowatt transformer on 13,000-volt line for the past three years and the operating experience has been very satisfactory.

J. M. Fried
Poughkeepsie, N. Y.

Our system covers a large area with many miles of 10,000-volt lines constructed for power purposes. We are supplying many ranches

with power for irrigation, and in a few instances we sell current wholesale for small towns where local companies have been organized to retail light and power.

Our system is divided into territorial districts with a local office in the principal town of each district, and where ranches and villages are within a reasonable radius, their requirements are handled on a retail basis through our district offices.

We have experienced little difficulty in handling the business on this basis, as the majority of the ranches have telephones, and the roads during the pumping season, in fact, for the whole year, are accessible for motor cycles or automobiles.

R. H. Ballard, Secretary and Assistant General Manager
Southern California Edison Company
Los Angeles, Cal.

The Northern Colorado Power Company uses a voltage of 2200 for its secondary distribution. The Eaton Electric Company uses 6600 throughout its various towns and serves a number of individual farms from small single-phase transformers placed upon this line. This service seems to be entirely satisfactory but it is natural that the transformer losses are rather great as compared with the amount of energy sold. There is another instance in which a town of about 500 people is served from an 11,000-volt line. This is Montezuma, Colorado. At the present time they have only one 7½-single-phase transformer in use on the power line of the Summit County Power Company.

E. C. Reybold, Jr.
Denver, Colo.

18—9. Is there any reliable and simple method which can be used by a cable splicer in determining whether or not a single-conductor, or multiple conductor, lead-covered cable, is carrying current which does not require removing the lead from the cable? This question refers particularly to cables carrying alternating current and the object is to prevent a cable splicer from removing the lead, or otherwise cutting into the live cable, in case the records are incorrect.

It is many years since I had to do with trouble hunting on underground cables, so that I am not really in a position to enlighten members on the most recent practice, but I assume there could not be very much change from what we used to do in 1895, except, perhaps, the methods are somewhat improved and less delicate. In 1887 when I was with the Commercial Cable Company the lines were traced out entirely by use of a small triangular coil of small wire (No. 32 B. & S.) connected in series with a telephone. This coil was carried along the surface of the ground while an intermittent current was sent through the cable being traced. The cables were three feet below the surface of the ground but no difficulty was experienced in tracing them out.

On the introduction of alternating current, however, this was found to be impossible, so the triangular coil had to be put nearer the cable. Still when underground cables were first installed and poten-

tials up to 2200 volts were used this device was found to be quite satisfactory in tracing out live cable, for there was a distinct hum when the coil was laid alongside one. Duplex cables however gave some difficulty but with finer windings and especially shaped coils, distinct sounds could still be heard.

There are at present on the market, two devices, and I think descriptions of one or both of them were published in recent issues of the electrical journals. One of them is in the form of an electro-magnet with the pole pieces wide enough to admit of a cable of fair size. The suspected cable is then of course at right angles to the coil and this coil is connected with a small head receiver (telephone). Another device is similar and is used on three-phase cables, while the pole piece opens up so as to span one entire turn of any one of the cables inside the lead sheath. All of these devices can be used without removing the lead.

E. W. Stevenson
Hazard Manufacturing Company
Wilkes-Barre, Pa

A very satisfactory device for use in determining whether there is current flowing in lead-covered cables, without removing the lead sheath, consists of a coil of wire consisting of approximately 500 turns of No. 30 or 32 B. & S. gauge, and a telephone receiver. By placing this coil against the cable and listening with the telephone receiver, any flow of current in the cable will make itself evident by noises in the receiver, thereby making it possible to be sure that there is current flowing in the cable before any attempt is made to work on the same.

L. L. Elden
Boston, Mass.

This company has been unsuccessful in finding a method by which a cable splicer can determine that a cable is alive; that is, alive and carrying no current. We have, however, been using a small coil with a telephone receiver with which cables carrying alternating current under load can very readily be picked out.

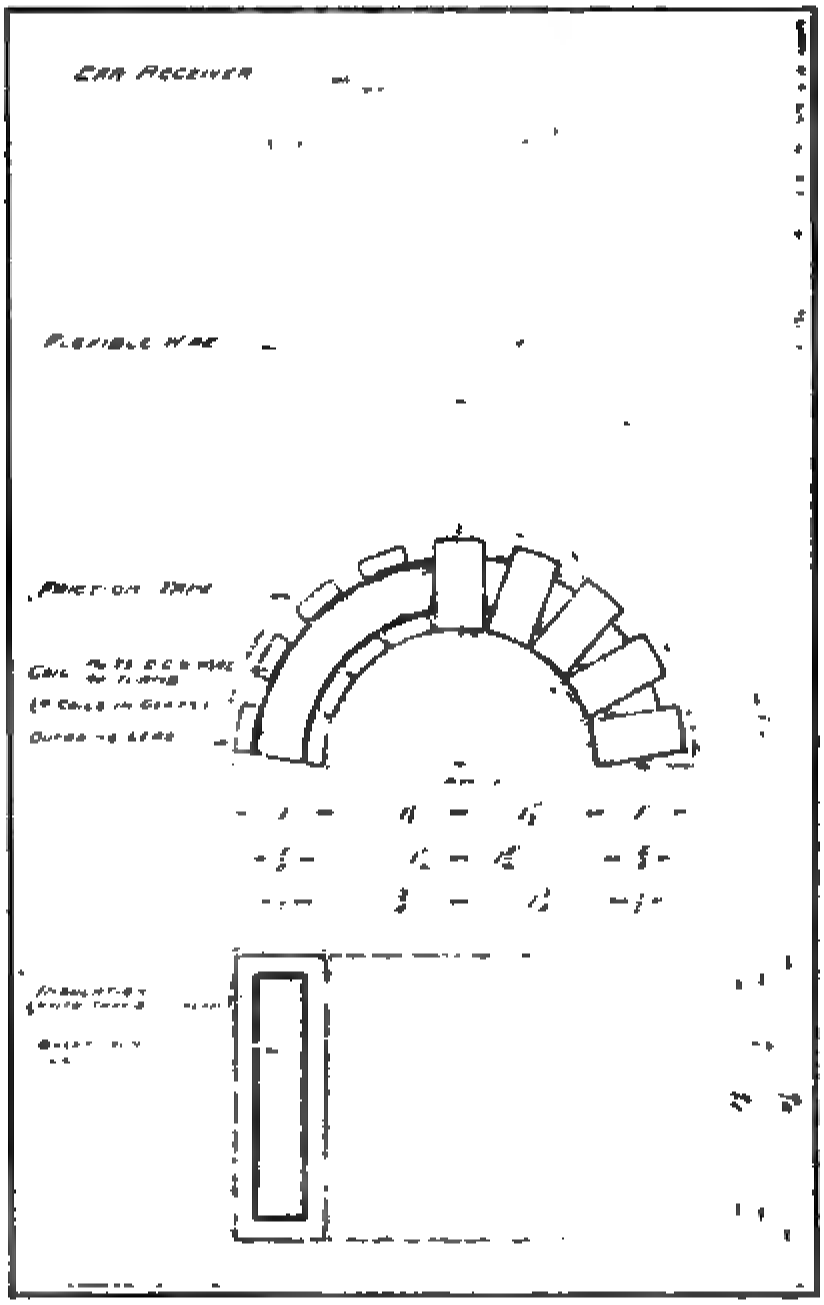
We have been using this device (see cut, page 150) for some years and have found it a great help in locating cables which were carrying load. Cables carrying 25 cycles current can readily be selected from those carrying 60 cycles. This being a current transformer, no sound can be heard in the receiver unless the cable is actually carrying current; in other words, if a cable is merely alive and carrying no load, no sound will be heard in the receiver.

W. E. McCoy
United E. L. & P. Company
New York.

16—28. Is it as good practise to hang arc lamps with metal chains as it is with cords containing automatic safety devices? We use a chain with a strain insulator, which works very well, but is

possibly open to the objection that the metal is a conductor which makes an added liability. However, as our lamps have heavy insulation over the hood, it would seem as if there were very little chance of danger.

We consider the use of chains for arc lamp suspension good practice, and with proper installation believe no danger exists. We use above each lamp a good standard absolute switch cutout with insulated suspension and between that and the chain a ball type of high tension insulator (good for 6000 volts), giving three insulations



ANSWER 13—9. SEE PAGE 149.

between chain and lamp. Use of strain insulator or equivalent type at pole end of chain as a further protection to trimmer is a matter of opinion, but in our judgment unnecessary, as the chain should be kept clear from possible contact with wires. Lamps and cutouts

should always be kept clear from accumulations due to bugs, bird nests, etc.—grounds often resulting from this source.

D. W. Emerick
Fulton, N. Y.

16—80. What systems or methods have member companies, which supply free renewals, of guarding against theft of lamps?

All incandescent lamps are marked with an acid etching stating that they are the property of the company and not to be sold. This enables them to be identified wherever found. All requests for lamp renewals are checked with the card file which shows whether the customers are entitled to free renewals. All employees are held responsible for stocks of lamps under their charge and for moneys collected for the sale of lamps. Lamp stocks are inventoried regularly and compared with office records.

H. B. Gear
Chicago, Ill,

16—81. Is it worth while to use low-voltage tungsten lamps for signs, or is the improvement in high-voltage likely to make the transformer expense unjustifiable?

We think the answer to this question depends upon the difference in cost of service to the company between present carbon filament lamps and five watt tungsten lamps; if the saving is great enough, then the change is justifiable.

Thomas W. Peters
Columbus, Georgia.

We are encouraging the use of the 5-watt, 10 to 12-volt tungsten sign lamps, and are installing a great many of them. There appears to be no immediate prospect of tungsten sign lamps for higher voltages.

A. G. Rakestraw
Wilkinsburg, Pa.

The advance in high-voltage tungsten lamps does not justify the elimination of transformers, and if tungsten lamps are to be used at all for signs, they must be low-voltage lamps.

The writer does not know of a high-voltage 4-candle-power tungsten lamp and does not believe that this candle-power should be increased except in special cases.

W. S. Wallace
Rochester, N. Y.

A 110-volt, 4-candle-power metal filament lamp would seem so uncertain a proposition that it would hardly do to turn down good business while waiting for its production.

Lloyd Garrison
Ogden, Utah.

We have used low-voltage tungsten sign lamps for the past year and find that the life of these lamps is so great that a customer

can easily afford to purchase the necessary transformer. One sign which uses 170 5-watt, 10-volt tungsten sign lamps has been in operation for over a year, burning approximately 2000 hours and as yet only one lamp has burned out. **W. R. Putnam**

Marinette, Wis.

We have between 5000 and 6000, 11-volt, 4-candle-power sign lamps in operation in Muskogee, and are adding same at the rate of 800 to 1000 per month, (during October, 1504). We find a very low percentage of renewals have been necessary since the first lamps were put up, over a year ago. On account of the high winds which prevail in Oklahoma, we feel that these lamps have been subjected to a very severe test, and have stood up remarkably well. In view of the fact that our customers are so much better satisfied with the tungsten lamp, we feel that the transformer expense is entirely justifiable. **Norman B. Hickox**

Muskogee, Okla.

16—22. We are desirous of having all the information we can get on the subject of series Mazda for street lighting. We desire to know more particularly the prices paid in localities where this form of lighting has been adopted and also would like to have some facts comparing this form of illumination with arc light illumination for residence sections.

We have 104, 6.6 amperes, 50-watt series Mazda lamps on our street lighting circuits which run on a 4000-hour schedule, and for which we receive $19.80 per year. We had some trouble with defective vacuum and breaking of joints between filaments and leading in wires, but at present are getting excellent life (1000-2000 hours) and maintenance of candle power. We found by actual photometric test that these lamps after burning 300 hours gave a little more effective light than a so-called 80-candle-power inverted burner gas lamp with a new mantle. We have just renewed a 250-watt series Mazda which had burned a little over 1600 hours. It had not burned out but was going down rapidly. It had, however, maintained its candle power surprisingly well up to the last 200 hours. As near as we can judge, one of these lamps, will, during its useful life, give about the same effective light as a 6.6 ampere alternating-current enclosed arc.

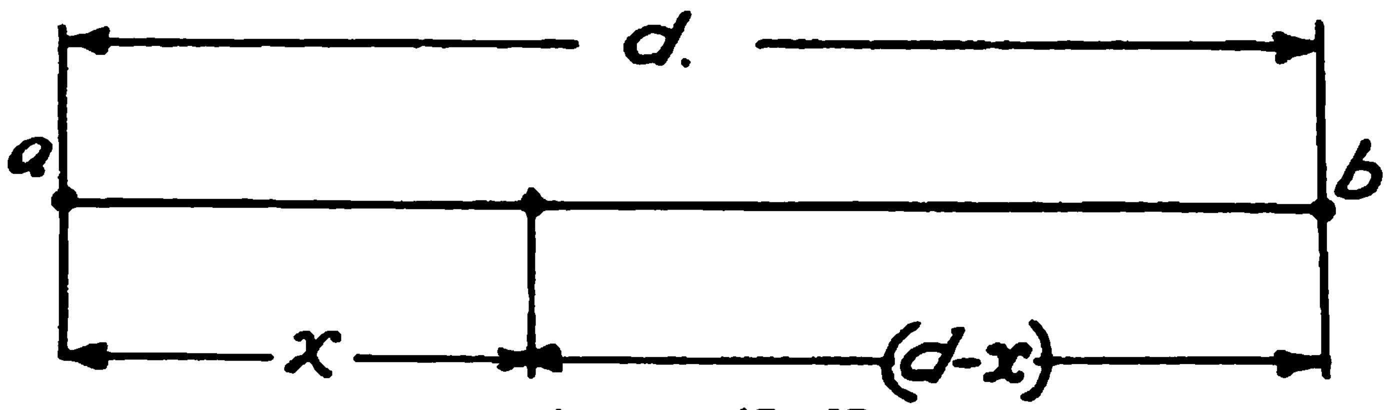
H. A. Fee

Adrian, Mich.

17—27. Two lights, A and B, are 10 feet apart. The intensity of light of A at unit distance is 5, that of B at unit distance is 8. Find the point between these two lights where the illumination is a minimum.

I send herewith a general solution and also a special solution applying to the figures given. The question is worded somewhat

peculiarly, but I take it that it means that the candle power of light "A" is five and light "B" is eight, although it states that the intensity at unit distances is five and eight respectively. If we call the candle power of one source "A" and the other "B," and the distance between the two lights "D," then the solution will be as follows:—



ANSWER 17—27.

Let y = illumination at point x, a minimum

$$y = \frac{a}{x^2} + \frac{b}{(d-x)^2}$$

$$\frac{dy}{dx} = \frac{-2a}{x^3} + \frac{2b}{(d-x)^3}$$

Equating this to zero and solving we get

$$x = \frac{d\sqrt[3]{\frac{a}{b}}}{1 + \sqrt[3]{\frac{a}{b}}}$$

Application in this example

$$\begin{aligned} a &= 8 \\ b &= 5 \\ d &= 10 \end{aligned} \qquad x = \frac{10\sqrt[3]{\frac{8}{5}}}{1 + \sqrt[3]{\frac{8}{5}}} = \frac{11.7}{2.17} = 5.4$$

i. e., the illumination will be a minimum at approximately 5.4 feet from the stronger light of eight candle power.

The illumination at this point will be

$$1 = \frac{8}{(5.4)^2} + \frac{5}{(4.6)^2} = .513 \text{ F. C.}$$

It is interesting to note that if we should calculate the illumination at a point half-way between, namely, at five feet, we would get almost as low a value, or .52 foot candles, whereas if we should take the illumination at six feet from the stronger light, we would get an illumination of .535. I simply give these two values to show that the point given is a minimum, and higher values are obtained on either side of it.

V. R. Lansingh
New York.

Another reply giving the same solution by identically the same process is furnished by Alden W. Welch of Brooklyn, N. Y. Mr. Welch also adds: "This point can be determined graphically without the

use of calculus, by substituting assumed values for X in the first equation, and solving for the Y values. Plot a curve using the Y values as ordinates and the X values as abscissae. The curve so obtained will be approximately U shaped and the point representing dimmest light will be the lowest point on the curve."

20—68. What practise have member companies in regard to inactive meters? Are meters promptly removed or permitted to remain on the chance of securing new business, and if so, how long?

When meters are disconnected, a special lead memo. is sent to the district agent in charge of the territory, who investigates conditions, as to whether or not meter should remain on premises, and if not, he issues order to remove meter. These lead memos. are followed up until the meter is either reconnected or removed. We have a record of all meters disconnected and the reasons why they are not reconnected or removed.

J. L. Wiltse
Brooklyn, N. Y.

Meters are removed as soon as possible after premises are vacated.

Nashua Light, Heat and Power Company
Nashua, N. H.

If the owner of a house desires the meter left in, we charge a monthly minimum of fifty cents, otherwise meter and fuses are removed and the service cut. We also place a card in some prominent place to notify the next tenant that the house is equipped for electric service, and give our telephone number, name and address.

North Shore Electric Company
H. B. Williams, Meter Foreman
Chicago Heights, Ill.

Whenever a meter becomes inactive from customer permanently discontinuing use of current, it is removed, returned to meter shop, tested and placed in stock. Meter investment is thus kept down and the loss of meters from theft or fire is minimized.

In the case of temporary discontinuance, the wires are taken from the meter and the meter is allowed to remain in place, the customer assuming all responsibility for the loss of or damage to meter.

William Rawson Collier
Atlanta, Ga.

When a customer gives notice of leaving premises, the meter is immediately read and inquiry made as to future tenant, and if a favorable answer is received, the meter is left in the building, a card sent to the incoming tenant asking him to sign a contract, or an agent calls and gets the contract signed if premises occupied. If premises remain vacant after ten days, the meter is removed.

R. Manser
Toronto, Canada.

We remove all meters as soon as we receive notice that the premises are vacant. This notice may come in through the regular notice from the customer asking for discontinuance of service, or from notice furnished by the meter readers on their regular meter reading rounds.

Thomas W. Peters
Columbus, Georgia.

Where a house of the better class is a good renter, we allow the meter to remain with the fuses out for a month, otherwise meters are removed as soon as possible after the house is vacated unless a new tenant is in sight. If the meter has not been tested within six months, it is brought in in any case.

H. A. Fee
Adrian, Mich.

Some of our district superintendents remove all meters at once, and others leave them in a house as long as there appears to be a good chance that it will be occupied. Personally, I think that in a district where houses are not long left vacant, it is a good plan to leave them in 30 to 60 days. It saves considerable labor and enables the company to connect more promptly. Solicitors should be furnished with a list of such locations and report periodically.

A. G. Rakestraw
Wilkinsburg, Pa.

We have all of our meters brought into the shop on discontinuance of any service, and every meter is tested before being put into service again, regardless of how long it has been out.

W. G. Claytor
Roanoke, Va.

It is our practice to remove inactive meters at once.

W. R. Putnam
Marinette, Wis.

Unless the premises are rented to another occupant who takes possession at once, the meter is promptly removed.

J. H. Enright
Frederick, Md.

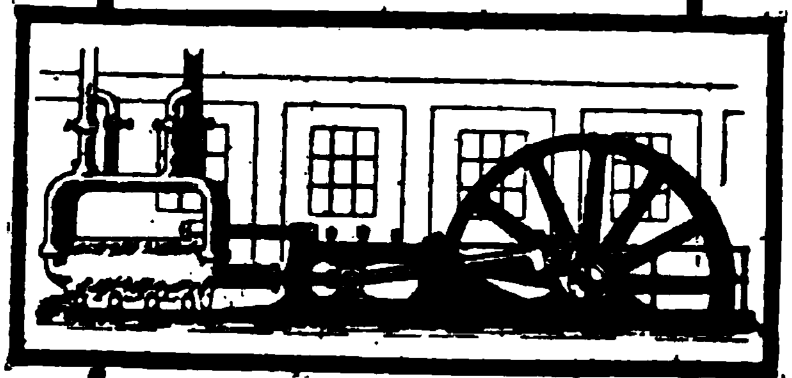
All meters are promptly removed when consumer moves out, or orders meters out on account of moving.

Norman B. Hickox
Muskogee, Okla.

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

This ad. made quite a stir here and led to many enquiries.

ELECTRIC POWER—ELECTRIC POWER!



This Enormous Refrigeration Machine is Driven by Electricity!!

Those who doubt the EFFICIENCY and the ECONOMY of Electric power should visit the plant of the MANNING COLD STORAGE COMPANY, and see in operation this huge refrigerating machine—one of the largest in Canada.

It is run by a 200 h.p. motor. This is only one of the many electrically-operated machines at the Manning plant. Electric motors of almost similar size are installed in the factories of the DUNLOP RUBBER TIRE CO., STANDARD SANITARY CO., CITY DAIRY CO., NEILSON'S ICE CREAM CO., NATIONAL IRON-WORKS CO., HENRY DISSTON SONS CO., BRITISH AMERICAN OIL CO., and a great many other manufacturing concerns, many of whom have within the past six months entered into long-term contracts for the supply of electric power, which testifies to the reliability of Toronto Electric Light Company Service.

The installation of CENTRAL STATION power by the above firms has reduced their insurance rate, it has cut down their power costs by eliminating shaft and line loss, and it has made their establishments models of cleanliness.

What Electricity has done for them it can do wherever power is required.

It also lowers the cost of overtime work by cutting out overtime wages for engine and boiler-room staffs, by eliminating the expense of running the entire plant when only part of its machinery is required. Why run your own plant when our Complete System is at your service?

We Have Power For All Toronto!!!

PHONE MAIN 3975

Our Experts are at Your Service

USE

TORONTO ELECTRIC LIGHT COMPANY

SERVICE

12 ADELAIDE STREET E.

"The Electric Building"

21—15. Is it feasible for us to furnish power to operate the local fire-alarm system from our 110-volt direct-current mains, or can it be done from a motor generator set? It takes about 80 gravity cells to keep up the system (the Gamewell) and costs $125 per year for chemicals. Besides cost of chemicals (acid, blue vitriol and lead plates) it costs $800 per year salary of man to keep battery in condition. Would like to have the experience of member companies which have operated such systems from central-station mains as to kilowatt-hours required, apparatus necessary, cost of same and all details.

Our company is supplying 110-volt alternating-current to the local fire department for operating a motor generator set to charge storage batteries, used in connection with the Gamewell fire-alarm system.

Our service has been in use thirteen months and for the year ending September 31, 1910, 465 kilowatt-hours were used, costing the department, at our rates, $41.10.

The apparatus is located in the fire department headquarters and consists of 39 cells of battery, switch board, with the necessary instruments, and one-quarter-horse-power motor generator, 110 volts alternating-current and 125 volts direct-current, also automatic switch which throws on the lights in the engine house, at the first stroke of alarm bell.

This equipment cost $750. The fire district is made up of three circuits with a total of 21 boxes or stations. During the year, the only expense for maintenance on the electrical apparatus (not outside circuits or boxes) was sixty-four cents for generator brushes.

The writer is of the opinion that the use of 110-volt current from direct-current mains for this purpose, is both feasible and economical.

E. M. Addis
Brattleboro, Vt.

The fire-alarm system in this city has been operated by a motor-generator supplied from a central-station since January 30, 1904. Since that time, it has run continuously except by failure of the supply circuit which is very rare. The motor-generator set is one-sixth-horse-power motor, 120 volts; one-sixth-horse-power generator, 50 volts, 1.4 amperes. It supplies 29 Gamewell boxes. Load on motor 20 watts; load on generator 4.675 watts. Before installing this system the renewal charges for battery were $190 per year. Cost of batteries $110. Cost of motor-generator set $88. Cost of energy at 12 cents per kilowatt-hour, $21 per year. Cost of repairs, maintenance, etc., nothing. It has saved the city since being installed, over $1,000, beside giving better service. Volts on fire-alarm system 55; amperes on fire-alarm system .085.

George F. Eisenhower
Lebanon, Pa.

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

We held an iron demonstration in one of the best windows in town and sold outright 40 irons as well as getting the advertising.

Utah Light and Railway Company
Salt Lake City, Utah.

21—17. What companies pursue active campaigns for electric sign and outlining business, and are special rates made for this class of business?

The Toronto Electric Light Company, Limited, is pursuing an active campaign for electric sign and outlining business and the results are all that can be desired. We make a special rate for this class of business, of eight cents per two-candle-power, 14-watt-lamp, per month, on schedule of burning from dusk to 11 P. M., 313 days in the year. This business must be worked up and clever men employed with the ability to convince the public that electric advertising draws trade twenty-four hours a day; that the circulation of an electric sign is limited only by the number of people using a street or avenue, and that an advertiser will benefit his city by helping to brighten its streets. Care must be used, however, that other forms of advertising, particularly that of the newspapers, is not condemned. Remember that there is merit in the other man's goods as well as yours.

Eugene Creed
Toronto, Canada.

The Brooklyn Edison Company pursues an active campaign for electric sign and outline business. Special rates are made as follows: $2.75 per year for each 4-candle-power carbon-lamp installed; $4.00 per year for each 8-candle-power-lamp installed. This rate includes patrol service and lamp renewals, the signs being switched on at dusk and off at midnight every night during the year and averaging 1856 hours per annum.

This rate has proved advantageous both for the customer and for the company. It applies only to outside lighting. The customer installs a special patrol switch on the outside of the building not over seven feet above the sidewalk. These switches are padlocked, the company keeping the key, and are provided with a hole in the cover of the box through which a switch key can be inserted without unlocking.

Parker H. Kemble
Brooklyn, N. Y.

We give a special rate for sign and window service. This rate we call our advertising rate, and is a flat rate based on 1900 hours per year at an average of approximately six cents per kilowatt-hour plus renewals. We find this rate very satisfactory as it takes all trouble of maintenance from the customer.

Thomas W. Peters
Columbus, Ga.

We are conducting an active sign campaign with the aid of the tungsten sign lamp. We are securing a good deal of sign business on a flat-rate basis. We also carry certain stock signs, for the more common lines of business which we put out on the installment plan. The rates charged vary from 10 to 12 cents per lamp per month, including lamp renewals and care of sign. We have one sign solicitor and an assistant, who are kept very busy looking after this business.

A. G. Rakestraw
Wilkinsburg, Pa.

We have in force a midnight flat-rate of approximately one and one-half cents per watt installed and a similar rate of two cents for all night. The minimum charge, including $1.50 patrol charge is $5.00. Increasing discounts are allowed for sums above $25.00.

Lloyd Garrison
Ogden, Utah.

We are operating a 110-volt special street lighting circuit. The lamps burn from dusk till midnight. We have made a special campaign to secure electric signs and outline lighting on this circuit. We make a rate of five cents per kilowatt-hour for all business secured on a year's contract; payments are divided in twelve equal parts and are paid monthly. No lamp renewals are furnished and the circuit is controlled from our sub-station.

W. R. Putnam
Marinette, Wis.

RATES ON ELECTRIC SIGNS

Burn from dark to midnight, turned on and off by company; free lamp renewals in all cases.

SIGNS OWNED BY THE COMPANY

2 candle-power carbon lamps, per month, each..............18 cents
4 candle-power carbon lamps, per month, each..............20 cents

PANEL SIGN

4 candle-power carbon lamps, per month, each..............36 cents
8 candle-power carbon lamps, per month, each..............50 cents

SIGNS OWNED BY CONSUMER

2 candle-power carbon lamps, per month, each..............12 cents
4 candle-power tungsten lamps, per month, each............12 cents

PANEL SIGNS

4 candle-power carbon lamps, per month, each..............28 cents
8 candle-power carbon lamps, per month, each..............40 cents

We are adding an average of 1000 sign lamps a month.

Norman B. Hickox
Muskogee, Okla.

22—32. Will member companies reply as to their policy in supplying current for lighting purposes to customers using a large amount of power current, that is, whether the lighting current is charged for at

the regular power rates, or whether or not customers are allowed to use motor-generator set or static transformers for their lighting system, paying for the primary current at power rates?

We define the difference between power and light according to the use made of the current, so that current supplied to run a motor-generator set for lighting purposes would be defined as lighting-current and would be charged at the lighting rate.

We have both power and lighting rates, with wholesale and long hour discounts applicable to each.

Customers who use a large amount of light in proportion to their power, usually find it cheaper to take their power on the lighting rates.

When, however, the amount of power is a large proportion of the total use, small customers and medium-sized customers, say up to 200 or 300 horse-power, usually find it cheaper to take their power at the power rate and their light at the lighting rates.

Almost all large customers, say over 300 horse-power, find under our rates that it is cheaper to put their power on the lighting rate than to take a separate meter.

The reason of this is, of course, that the combining of the power and light increases the long hour and wholesale discounts more than enough to balance the differential between power and light in these cases.

R. S. Hale

Boston, Mass.

We have no regular rule which we follow in this matter. It is better to make separate contracts, because since the load factor of the power and the light are different, the rate should vary accordingly. Where the two are put on the same meter, we have to guess how much extra profit must be made on the power to cover the loss on the light. This means a chance for a wrong guess, and consequent loss to the company. We have frequently to do this, however, as some customers would consider it an imposition if we tried to secure a contract for the light at lighting rates. I think the ideal way to do this is to put in a curve drawing instrument and base the rate on the hours use per month of the maximum peak demand.

A. G. Rakestraw

Wilkinsburg, Pa.

If customer installs and renews his own lamps, we must supply him on any power schedule he may elect, whether all the energy is used by motors or not. If power is purchased at our primary voltage we have no authority over the use to which it is put, whether motor-generator, drive or static transformer supply, provided such use does not interfere with our service. It is, of course, for us to advise and for the customer to decide whether he should combine his light and power on one schedule or not.

There is, aside from the question of free lamp renewals, a basic reason for higher charges for lighting than for power service, since the former naturally creates the expensive peak demand, but this condition should be met by a logically drawn system of charges which is based on the nature of the demand rather than on the use to which the energy is devoted. (See "Electrical World," pp. 1048-1051.)

John C. Parker
Rochester, N. Y.

At lighting rate, unless customer uses motor-generator set, then he is allowed to go on power rate.

J. M. Fried
Poughkeepsie, N. Y.

The wholesale power contract of the Brooklyn Edison Company allows for lighting, not to exceed one-third of the total connected load, provided the total bills for current exceed $2400 per year. As the maximum power demand comes usually before noon, and there is a falling off in the power load toward the close of the day's work, the lights of large customers increase the demand but a small amount above the morning peak in Brooklyn, as most factories close down from 5 to 5.30 o'clock, and on Saturdays, at noon or 3 o'clock. It will, therefore, be seen that the lights of large wholesale power-users have but little effect on the company's peak load.

C. A. Graves
Brooklyn, N. Y.

The current used for lighting purposes is never charged at the regular power rate; for large consumers (that is, customers using at least 100,000 kilowatt-hours annually) a special rate is made at which current may be used for either light or power purposes, the customer furnishing his own incandescent lamps, arc lamps, trimming the same, and attending to all repairs, etc.

For those customers who install their own motor generator, and are able to use current at high-tension, (namely 6600 volts), a special high-tension service rate may be made.

Arthur Williams
New York.

The Commonwealth Edison Company has a wholesale schedule of rates for electricity which is the same for lighting and power service without lamps. On account of the existence of this schedule, we have no demands made on us for the furnishing of electricity for lighting purposes through motor-generator sets. We serve the customer direct from our lines, either alternating or direct-current service, according to location. We believe our wholesale schedule, which is based on the "Hopkinson Method" to be the proper schedule for the sale of electricity to the larger class of consumers.

E. W. Lloyd
Chicago, Ill.

In Minneapolis our power business is divided between wholesale and retail. The wholesale class is established by the use of power at 2300 volts, three-phase, and guarantees a minimum of $200 per month for 100 horse-power and $2.00 per horse-power for each horse-power in addition. Under these wholesale contracts we permit five per cent of the current used for power to be used for lighting purposes through static transformers. On retail power installation we do not permit the use of current for light. This arrangement for wholesale power has met all our conditions in Minneapolis.

H. J. Gille
Minneapolis, Minn.

Current used for lighting purposes should be charged on a lighting basis and current used for power purposes on a power basis. Therefore, any current used for lighting that passes through a power process before being used, should be charged on a lighting basis.

Douglass Burnett
Baltimore, Md.

We allow some of our large power consumers to connect static transformers to their wiring, after the current has been measured on their power meter, giving them a power rate for their lighting.

Nashua Light, Heat & Power Company
Nashua, N. H.

Wholesale consumers are supplied with lighting service at the same rate as for power, the current being measured on the primary side of the transformers, the customers furnishing lighting transformers at their own expense. The lighting capacity is added to the power demands in ascertaining the basis for the minimum charge.

G. K. Hutchins
Columbus, Ga.

Regardless of the amount of current that a customer uses, all lighting current is sold at lighting rate and power current sold at power rate. For the purpose of obtaining current for lighting, motor generator sets and static transformers, on power lines, or generators belted to shafting, are not allowed.

William Rawson Collier
Atlanta, Ga.

22—82. Is there any company having in operation a flat-rate window-lighting agreement? If so, what is it and how does it work out?

The Leamington Light & Heat Company, Limited, have window lighting circuits, which are turned off at 11 o'clock week nights, and at 12 o'clock Saturday nights. All lights of these circuits are operated on a flat rate charge. This lighting is very satisfactory to the storekeepers for it makes unnecessary all time switches in the customers' premises and it is satisfactory to the company for it

reduces the consumption of current by all customers who pay for their store lighting on flat rates.

Robert S. Stewart, President,
The Leamington Light & Heat Co., Limited,
Leamington, Mich.

We are operating a flat-rate window agreement on certain retail business streets. The lights are turned on by lock switch at dusk and turned off at 11 P. M., by patrol. The rate is fifty cents net per 16-candle-power equivalent per month. The plan is entirely satisfactory.

William Rawson Collier
Atlanta, Ga.

Our flat-rate window lighting is based on the rated consumption of the lamps and number used in the installation per hour, having our own man to light and extinguish same.

The system works admirably.

J. H. Enright
Frederick, Md.

See our answer to 21—17. We have obtained very satisfactory results on this business. A customer using this service on a meter at regular rates would pay five and seven-tenths cents net per kilowatt-hour. However, if a customer was operating this service on a meter they probably would not burn their lights more than one-half the time they are now burning.

W. R. Putnam
Marinette, Wis.

22—24. (a) Is it advisable to change the method of charging on a kilowatt-hour basis to a "readiness-to-serve" system where the former system has been in operation twenty-five years?

(b) If the "readiness-to-serve" system is best for the consumer and the company, why do the "readiness-to-serve" companies permit the use of the straight kilowatt-hour system of charging when the "prospect" balks at the "readiness-to-serve" contract?

I am of the opinion that sooner or later we must all come to the "readiness-to-serve" method of charging, unless some new and better method is introduced. I know of no other system of charging which will meet every condition which comes up, and this system, properly apportioned between the three functions, will do this.

The phase "readiness-to-serve" has been made to apply generally to all sorts of modifications of the original readiness-to-serve system. The real readiness-to-serve system is made up of three charges—a consumer's charge, a capacity charge and an energy charge. I do not think it is possible to disregard any of these three factors and secure even a reasonable degree of equity.

Few electric companies can adopt the readiness-to-serve charge universally because their franchise requires that they shall sell at not to exceed a certain rate per kilowatt-hour, and, therefore, any

consumer can demand service on the basis of the rate named in their franchise. So up to date the readiness-to-serve system of charging is used simply as an optional system and a means of giving discounts equitably from the franchise rate.

If the readiness-to-serve system could be universally applied to all consumers it should bring about a great reduction in the cost of service to the community, both because it is the best way to encourage additional profitable business and because it would insure against unprofitable business, and if the central station were not compelled to make up losses on certain classes of consumers it could sell to the more profitable consumers at a lower rate, and the ability to sell at a lower rate would in turn encourage more liberal consumption.

Henry L. Doherty
New York.

23—17. What information can member companies give as to the ratio of disconnections to connections? i. e., what is the amount of business lost compared to the new business gained?

We find the ratio of connections to disconnections to be about two to one.

North Shore Electric Company
H. B. Williams, Meter Foreman
Chicago Heights, Ill.

Beginning with January, 1910, the following is the ratio of customers gained over those lost:

January	3	to 1
February	2.7	to 1
March	2.7	to 1
April	2.5	to 1
May	1.85	to 1
June	1.7	to 1
July	1.37	to 1
August	3	to 1
September	2.54	to 1

Thomas W. Peters
Columbus, Ga.

Our monthly report of connections and disconnections shows that for every eight 50-watt equivalents connected there are approximately five 50-watt equivalents disconnected.

J. L. Wiltse
Brooklyn, N. Y.

We have about 3000 customers; our average ratio of cut-outs to cut-ins is about one to two.

W. G. Clayter
Roanoke, Va.

With 1098 meters installed at the beginning of the year in a well developed and nearly stationary territory we installed 340 and removed 251 meters during 1909. **H. A. Fee**

Adrian, Mich.

We endeavor to get two for one and so far this year the average has been two connections to one cut-out. **J. M. Fried**

Poughkeepsie, N. Y.

24—22. Are there any companies in cities of over 100,000 which have done away with deposits, i. e., discontinued requests for deposits, and extended credit to practically all applicants? If so, what has been the results?

We extend credit to practically all customers, with the exception of those who have a poor credit standing, or who conduct certain classes of business, from whom we ask a deposit. These are usually saloons, restaurants, and some boarding and rooming houses. However, if the person conducting such business has previously been a customer of ours and paid his bills promptly, we do not require any deposit. In the residence section we ask deposits only from those who have the reputation of not paying their bills, and from people moving into the city from out of town, who are unable to furnish satisfactory local references. **W. T. Nolan**

Rochester, N. Y.

24—26. What steps do member companies take to secure and retain the good-will and co-operation of contractors? In other words, how do member companies deal with contractors so as to secure from them the highest degree of efficiency in securing business for both?

This company has at all times recognized the fact that a central station is primarily in business to sell current, and although we have on hand a large stock of motors and electrical supplies, we never compete with the local contractors in the sale of same, or in wiring work. This stock is held solely for the purpose of taking care of possible breakdowns of existing customers.

We have endeavored to co-operate with contractors in every case, keeping them informed of possible fields for new business, and we have invariably found that such a policy commands a similar return on their part, of mutual advantage to both parties.

W. H. Lines

Rochester, N. Y.

24—27. What method have member companies of securing information leading to detection of theft of current?

Clews leading to cases of suspected theft should be reported by meter readers, testers, inspectors and other employees who have occasion to be about customer's premises and who may see things

which look suspicious. After such clews have been reported a careful inspection of the premises should be made by an experienced man, followed by observations taken during the hours when current is used to discover any tendency toward an extravagant use of electricity. After such examination indicates that the suspicions are well founded, the next steps must necessarily depend on the situation of the customer's meter, arrangement of his premises, character of the service, etc. Where good legal evidence can be secured, it is very desirable to get a few convictions if possible, for the sake of the moral effect on the community.

In cases where employees of reputable concerns are responsible for the trouble, it is preferable to render an estimated bill for the service, based upon meter readings taken on a test meter located somewhere on the consumer's service, without his knowledge, prior to the time that anything is said to the customer.

As to the laws governing such cases, the questioner should refer to the paper read by R. L. Elliott before the Chicago Convention of this Association in 1903, entitled "Theft of Electric Current."

H. B. Gear
Chicago, Ill.

24—29. Would it be considered good business for a central station of 30,000-horse-power capacity, that has a heavy day load and evening peak of light and power, to take on large consumers who would use electric power between the hours of 10 P. M. and 7 A. M. at a rate equal to the cost of manufacturing current and delivering same to the consumer? It is assumed that the night load is comparatively light.

We should not consider this good business, because it ought to be possible to get large consumers at a considerably higher price than the central-station's manufacturing cost and it is unwise to take on large consumers at less than a fair price.

A station of 30,000 horse-power ought to be able to quote a price to any large consumer that should ultimately secure his business, whether the large consumer is going to use current at one time of the day or another.

Of course, in order to secure the business of an existing plant where a customer has made his investment in an isolated plant, it may be necessary to quote a lower price than would be necessary to get the business of a customer who had not purchased his isolated plant as yet. In such cases, however, it would be better to make the differential by purchasing the plant rather than by making a lower price for current, since if this is done, then when a later customer comes along with a plan to put in a plant, the fair price can be secured from him without discrimination.

R. S. Hale
Boston, Mass.

I do not see why, under any circumstances, a central station should sell its energy for cost. At times off-peak, such a company may secure business by reducing the primary charge per kilowatt of demand (that is to say, that part of the rate representing interest, depreciation, taxes, insurance and other fixed charges on the investment) to the price representing the actual fixed charges against such consumers, and maintaining their secondary charge (that part of the rate representing the operating charges plus the profit) on a profitable basis. Such business can be secured at a price that is higher than cost and still, in the average case, below the consumer's cost, by a proper analysis of the company's fixed charges against investment plus operating costs. **E. W. Lloyd**

Chicago, Ill.

We make a limited service rate for current used off of our peak. This rate limits the use of the current by the consumer to predetermined hours. There is no question that a limited service rate is justified by the conditions that obtain in the furnishing of public service where the demand on the investment by the public is practically predetermined. The use of the machinery and distribution system, other than this period, should be available for use provided the consumer agrees not to use the service when it is demanded in the furnishing of the service to the public. The rate that should be fixed for this class of service would depend on the cost thereof to the company as well as the value of that service to the customer; by this I mean, that there should be a fair division of the saving to the customer by furnishing this service. It must also be borne in mind that no rate can be made for this class of service that will place a burden on other consumers, in other words this service must be furnished at a profit. It goes without saying that business of this character is not only extremely desirable and can usually be secured at a profit, but it tends to reduce the cost of the total business by increasing the efficiency of the station equipment and labor.

H. J. Gille

Minneapolis, Minn.

It would not be good business for any company to ignore its fixed charges and general expenses in making a contract with its customers. **Douglass Burnett**

Baltimore, Md.

It would seem to be a most desirable thing to secure the use of electric power between 10 P. M. and 7 A. M. though the rate received appeared to be only that of the cost of manufacturing the current and delivering it to the customer.

This will have a tendency to even up the load factor and thereby bring down the present manufacturing costs; and, while the per cent of profit may not be great, in reality it would add substantially to both gross and net earnings.

This company has made a special effort to get this kind of business and has felt justified in making an extremely low rate to secure it. For example, the press work done by the morning papers is a most desirable addition to the late night load, and it can be taken on at what appears to be very low figures but which in reality yield some profit. **Frank W. Frueauff**

Denver, Colo.

It would not be good business to take such load at actual cost, unless it were done as a means of preventing the prospective customer from putting in a plant of his own and possibly entering into competition with the station. It seems to me, however, that under these circumstances, it should not be hard to quote a rate that would be attractive, and yet yield at least a small profit to the station.

A. G. Rakestraw

Wilkinsburg, Pa.

24—80. Is it policy for a central station to sell heating and cooking appliances at cost or less, or should such appliances be sold at such a profit as to make price not less than the price of same articles sold by contractors, supply houses and department stores?

The belief and practise of The Philadelphia Electric Company is embodied in the notation prepared by the Sub-Editors on the Revision of the Electric Heating and Cooking Section of the "Question Box," namely:

SELLING PRICE: In large cities where department stores and supply houses sell electrical appliances, it has been found advisable for central stations to sell at list price, in order to foster profitable co-operation, rather than invite unpleasant competition. The policy of selling at cost was found to result in deterring such establishments from handling electrical devices, thereby restricting the number of outlets for these goods. Another undesirable consequence was the arousing of a feeling of irritation or resentment on the part of department stores, who are either large customers or possible customers, and on the part of our natural allies, the contractors, many of whom sell supplies.

In referring to "list," this is understood to apply where list provides only the usual retailers' profit; but is not intended to apply where discounts are in effect.

The general tendency throughout the country is to sell heating appliances, with the exception of one or two leading articles, at a fair profit. This has been brought about by the establishment of substantial dealers carrying electrical goods, and by department and other stores taking up these lines, thereby materially increasing the opportunity for purchase on the part of the public.

The earlier practise of selling at cost is being changed, because of the above reasons. However, the general statement still holds, that the more appliances introduced the more current will be sold,

and the lower the price of any article, the greater the quantity sold; and possibly because it has been the practise of gas companies to sell heating appliances at cost, our practise began that way and still continues to an extent. There is some argument for this practise, as applied to one or two small articles—flat irons being the most conspicuous.

James L. Ayer, Boston, Mass.
Joseph D. Israel, Philadelphia, Pa.

(A large number of interesting Answers to this Question are crowded out of this issue, but will appear in the December Box.—Editor Q. B.)

24—81. Inquirer would like information from companies as to whether they attempt the right to cut off for an appliance debt. That is, if purchaser of cooking or heating appliance refuses to pay for same, do you disconnect, same as you would for a current debt?

If any bill for appliances, etc., is not paid within a certain length of time, we add the amount to the current bill, and if not paid then, we disconnect. We justify this action by a clause in our contract that provides that "current may be shut off for the non-payment of any bill under **this** or **any other** contract with the company." This action has been questioned from a legal point of view, but as far as I know, it has not been tested. In case of non-payment for the appliance, we usually manage to secure possession of the article, as we would rather do this than lose the customer.

A. G. Rakestraw
Wilkinsburg, Pa.

A clause in our regular lighting and power application reads as follows:

The company, moreover, may discontinue service at any time without notice when the customer has violated this contract, or any other contract for the supply of electricity existing between the parties hereto, or fail to pay any bill accruing under this contract on or before the 10th day of the month in which it becomes due, or if the customer shall neglect or refuse to pay promptly when due any sum, which by the books of the company he may owe it for electric current or otherwise, and whether under this contract or otherwise, and whether as principal debtor or as joint debtor, or as maker, indorser, surety, guarantor, or otherwise.

William Rawson Collier
Atlanta, Ga.

24—82. We would like to hear from member companies as to their policy and practise in supplying breakdown connections.

Breakdown service should be supplied at a rate made up of a yearly service charge per kilowatt of demand contracted for (payable in monthly installments) and a kilowatt charge for the current con-

sumed; or a service charge per kilowatt contracted for, as a yearly guarantee of current consumption, at the usual light and power rates. In either case, a circuit-breaker should be set and sealed at a point slightly above the contracted demand. The customer should pay the expense of service connection. C. A. Graves

Brooklyn, N. Y.

We furnish break-down service on the same terms as where we supply all the current. In other words, an applicant for emergency connection has to guarantee the same amount per month to get any given rate, as if there were no other service installed.

A. G. Rakestraw

Wilkinsburg, Pa.

NEW QUESTIONS

0—28. Please give information as to any firm manufacturing appliance or using electricity for cutting trees of such large diameter that they cannot be sawed. The idea is to use a transformer delivering a heavy current at a low potential to heat a wire or suitable conductor to press against the tree and burn its way through.

0—29. Horses, as is well known, are very susceptible to electric shocks; yet, how can the following cases, and especially No. 2, be explained?

(1) Horses passing a certain point on a street over which street railway rails were laid, had been noticed to show evidences of being shocked, and in some cases were thrown to the street. Is the explanation that there must have been a poor bond at the point, and that the horses touched one rail with a forefoot and the other rail with a hindfoot? Is this a satisfactory explanation and is there any other?

(2) On a pole carrying both telephone and electric light wires, telephone on top, a pair of 2300-volt, 60-cycle wires carried down the pole, rubber insulation, and thence in iron pipe underground across the street to transformers located inside a building; cobble-stone pavement on street; on numerous occasions, especially when pavement was wet, horses hitched to this pole apparently received shocks when coming in contact with the pipe carrying the wires. Ordinarily, made horses jump back. Possibly one or two may have been thrown to the ground. One horse was finally killed by a shock at this point. This was during a rain storm and some thunder and lightning, and there is reason to believe that some lightning disturbances came to the pole over the telephone wires, as the telephone people were troubled by lightning about the time the horse was killed. If a lightning discharge of some kind is the explanation, it does not explain the other shocks, and why was not the iron pipe a better conductor to

the ground than the horse's body, thus preventing any shock to the horse?

(3) A pair of 220-volt wires were carried in rubber insulation and in an iron pipe under a plain dirt road, the pipe being buried about two feet below the surface. The wires were fused on a pole adjoining. The insulation was apparently in pretty good condition, although there was leakage from one of the wires. Horses passing this point, especially when the road was wet, jumped and otherwise gave evidence of receiving shocks. Finally, one horse, when the road was wet, stopped when he came directly over the underground pipe, fell with his head between his front legs, and died within a few minutes. How can shocks be transmitted from the earth to animals under the circumstances above indicated?

0—30. This company desires at once any statistics which have been compiled and which are ready to access of the various charges and costs of ornamental street lighting systems which are being maintained in the various cities of the country.

To be of any use, this information must be received promptly.

4—2. We are buying a good grade of soft coal for $3.15 a ton in our bunker. Can a saving be made by buying pea coal at $2.50 a ton; and approximately what per cent of saving, leaving out the cost of changing grates; or would it be better to use a mixture of soft, with the pea coal?

10—35. When a station is to supply about 300 kilowatts in 60-cycle-polyphase load and about 100 kilowatts in railway load, is it better to use a motor generator or an engine-driven generator for the railway load?

10—36. Is it practicable to operate a 50-kilovolt-ampere 3-phase 60-cycle revolving-field alternator as a synchronous motor. If so, what efficiency would it have at full load and at half load?

10—37. A heavy 230-volt short-circuit occurred on the line of a three-wire private plant. One 230-volt generator and a balancing set were in operation. The short-circuit burned out five sections of the balancer set starting box. How could this occur, both generator and balancing set being protected by circuit-breakers?

10—38. Is it a correct thing to do to regulate the field current in a 200-kilowatt synchronous motor driving direct-current generator so that the power-factor remains at unity no matter what the load is? On the machine I refer to, there is no ammeter on the exciting circuit and the operator regulates the field strength according to the reading of the power-factor indicator as stated above. Is this correct or not, and why?

11—17. Please give sketch of connection of syncroscope (G. E.) on two-phase four-wire board with five machines.

12—36. Our experience has been in case of lightning storms that we have lost transformers close to poor grounded lightning arresters and have not lost a like make of transformer on the same line, but a mile or so away from any arrester, and this leads us to ask the following question: When pole line lightning arresters are properly installed in every way with the exception of the grounding, and that proves to be poor, or the ground wire broken, are such arresters a detriment rather than a protection to the line?

12—37. What success have member companies operating above 33,000 volts had with a telephone line attached to the poles or towers?

(a) On what length of line?

(b) What is the clearance between the power and telephone wires?

(c) Is the line transposed? If so, how often?

(d) What style of apparatus is used?

13—10. What method do other companies use to determine the location of a poor joint on an Edison feeder that will not carry load, but will still carry current enough to give full-voltage reading at its terminal?

13—11. What cable pitches do the various companies use? What were the determining factors?

13—12. What companies use cables of over 1,000,000 cir. mils cross-section?

15—49. What are the advantages in using air-blast transformers in place of oil cooled, for sub-station work?

15—50. Why are mercury arc rectifiers used on tungsten street lighting systems? Would not the ordinary floating transformers do as well?

15—51. Have member companies found mercury alarm contacts on thermometers used on transformers reliable?

What other device for giving an alarm in case of excessive heating has been tried?

16—34. Would the constant temperature in a drying room of 130 degrees F. for 10 hours per day have any effect upon the life of a Gem lamp? Would it tend to shorten its life?

17—28. Will some one suggest an efficient method of lighting moving picture studios which shall also be economical? Lighting must be shadowless and permit instantaneous photography. Reflectors shooting sharp rays of light cannot be used. Size of studio, 15 feet wide, running in length from 12 to 17 feet. Height 8 feet. Present system uses arc lighting of 700 amperes at 110 volts, cost $12,000 to install and is very expensive to use. Tube lighting has

been tried and found wanting. It possesses actinic properties but is not sufficiently concentrated. This is a growing class of business and will repay some study.

19—40. What per cent speed variation will a 10 per cent increase or decrease of voltage make on a normally loaded induction motor?

19—41. What experience have member companies had in allowing polyphase motors to be started with resistance devices in the primary instead of the ordinary auto-transformer?

20—69. We were greatly astonished to be informed by a large manufacturer of meters, that no other central station had ever requested them to increase the size of the registering train dials.

We feel that larger dials would greatly facilitate the reading of meters and reduce errors. If all the central-station managers, who feel as we do, will write the editor of the "Question Box," it may be possible to bring about the desired change. How many would like to see the dials larger?

20—70. What is the best method of measuring the simultaneous maximum demand for a customer having eight three-wire direct-current meters? The meters are connected from a sub-station bus, to which other customers are also connected.

20—71. Why should a single-phase induction watt-hour meter run 50 per cent slow and creep backward steadily, after a short-circuit on the house line?

20—72. What has been the experience of member companies with polyphase rotating testing standards?

21—18. We have been for some time negotiating with a steam railroad for supplying power for the operation of their shops, their requirements being about 750 horse-power. They have asked us for list of the steam railroads who are purchasing power for the operation of their shops in preference to operating their own plant. We have only been able to secure a few of these, and if any of the members have contracts of this character, it would confer a great favor upon us to give us the details of same. Also the amount of horse-power capacity involved.

22—34. In changing from a flat-rate of 12 cents a kilowatt-hour for lighting, to a combination of service charge and kilowatt-hour charge, is it advisable to discontinue the 12-cent rate entirely, after 60 days' notice, thus forcing customers to take the new rate; or allow the 12-cent rate to remain in force for two or three years?

22—35. What has been the experience of companies with flat-rate lighting contracts for long-hour burners, and residences, by using excess indicators or flat-rate controllers? Is the maintenance of these flat-rate controllers equal to or less than the integrating watt-meter?

22—36. Should the demand charges of a station be apportioned according to the customer's average maximum demand or to the customer's maximum average demand, or to both; also what is a fair method of apportioning these charges among off-peak consumers?

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given?

Are there any member companies giving off-peak rates or lower rates for cooking?

22—38. Concerning specifications for street lighting:

(a) Is it advisable to base a contract for arc lighting on a rate per lamp per year of a fixed number of burning hours, or to base it on the energy consumed?

(b) In the lamp specifications, what factors should be included in order to avoid ambiguity?

(c) What is considered the most definite unit of illumination?

22—39. What is the best schedule of rating for "abnormal' incandescent service, by which I mean large commercial contracts or contracts outside of the ordinary. Our standard rates for incandescent service here are eight and nine cents net for domestic and commercial service respectively, and as regards perhaps 90 per cent of our business, the rates are popular and acceptable, but it is the other 10 per cent that are deserving of better treatment that I am worrying about, and I would like to know as stated, what is the best way to grade the rate for quantity consumption on these contracts?

23—18. What percentage of the total number of customers connected, are disconnected, annually, for non-payment, in companies which have 10,000 customers or more?

23—19. What percentage of the total number of contracts with new customers, in companies having 10,000 or more customers, are accepted without a guarantee deposit?

23—20. In power plants from 100-kilowatt to 1000-kilowatt capacities where there have been both a modern steam plant and a gas producer plant, how do the total costs per kilowatt generated compare?

24—34. Do member companies furnish memorandum meters free of charge or is a rental charged for each meter, and if so, how much, where current is furnished to the owner or lessee of a large building who resells the service to the various tenants; such as office buildings, etc.?

24—35. How many credit men does it require to handle the total business of a company with 10,000 or more customers, and what is the method of passing on this credit?

24—36. What is the best policy for central stations as regards the renewing of tungsten lamps, also at what price should they be sold? By this we mean, whether they are to be sold at list prices, net prices, or should they be replaced free when burned out. This should apply to stations of our size. Our city has a population of about 28,000 with a station capacity of 1,500 kilowatts. Our present practise is to have all meter customers purchase their first installation of carbon lamps at $2.50 per dozen. After that, we renew the carbon filament lamps free when they are returned burned out, to our office. Tantalum lamps and Gem lamps we renew for 25 cents less than the list prices. Tungsten lamps we do not renew at all, but sell them at list prices. Also would it be better to raise our rates one or two cents per kilowatt-hour and then furnish free tungsten lamp renewals. Our rates for residence lighting average from 12 cents to 7½ cents net.

24—37. A small central station in Iowa, in town of 2500 people, finds it necessary to install a new 100 to 150-kilowatt direct-current, 3-wire, 110-volt generator; also boiler and engine, or an alternative.

We have read and heard a good deal about gas producers and oil engines. Would it be more economical to install either a gas producer or an oil engine? If so, which?

24—38. Would it pay a company with a night load only, and a revenue of less than $900 a month, to install duplicate machinery to guard against shut-downs?

24—39. Has any member company with a good portion of its lights on flat-rates had any experience with trying to operate a day load without changing the customers over to meters?

24—40. This company is operating three plants, furnishing water, gas and electricity. We have a new business department, whose activities cover both the gas and electric departments, and whose head is not under either the gas or electric superintendent. Neither are the gas or electric workmen, who do wiring, gas-fitting, etc., under the new-business department. This introduces questions of jurisdiction and responsibilty which are difficult of solution, and I should be glad if you will publish an inquiry as to the organization in use by different companies operating two or more distinct utilities in the same city—this not only as regards the new-business department, but covering the entire organization. References to any matter which has appeared in either books or periodicals, dealing with the operating organization of combined utilities, will be appreciated.

25—8. If an electric light company supplies current to a defective installation and a fire results, is the company in any way responsible? Will the installation of safe but unapproved wiring in a building vitiate any insurance that may be in force or increase the premium?

REPEATED QUESTIONS

The following recent questions have received no reply or inadequate reply. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

0—21. This inquirer seeks information as to the cities wherein permits are required from city authorities before overhead or underground service may be installed and as to how long it takes to secure such permits?

0—25. Will member companies give figures as to the period of time elapsing between acceptance of contract, and actual installation of service?

***0—26. At our power station there is but one man on duty at a time, there being two shifts of twelve hours each. We have had occasions where night men went to sleep on duty. A watchman's clock would meet this condition, but we wish to protect both the man and ourselves against the possibility of his being disabled and unable to 'phone or turn in an alarm. Several hours might elapse before conditions became known, possibly losing the man his life and ruining the plant.**

Required—an automatic system registering in half-hour or one-hour periods which would give an alarm either by whistle at plant or bell at distant point should the attendant not be present at the predetermined time to prevent its alarm. As the man has other duties and it might be impossible for him to be there just on the minute, such device should give him at least five minutes' warning, but should also be of such construction that he couldn't tamper with it to prevent its action for periods in advance, allowing him to cut it out entirely for several hours. It should thus answer the purpose both of a watchman's time-detector and a safety device.

Is there such a device on the market or any station where such a method or something similar is in use?

5—6. I have been much interested in some recent articles in the press in regard to the application of thermal storage to existing boiler installations, and if all that is claimed for it is true, it offers a very efficient and comparatively inexpensive method of increasing boiler capacity. I should like to know if any of the member companies have had any experience in the use of thermal storage in connection with their boiler plants. To what extent does this increase the capacity of the boiler? Have such storage tanks been used successfully for purifying the boiler feed as well as increasing the boiler capacity? Does the application of this system increase the general efficiency of the boilers due to more even operation? Is the priming of the boiler under overloads decreased?

12—28. Will some member company which has used concrete poles tell something as to results and costs?

*12—31. The question we asked (17—23), first published in the June issue, was not properly stated. Please put it this way:

Our system of distribution is aerial and we endeavor in the commercial districts to, as far as possible, run our lines in the lanes. These lanes are generally sixteen feet wide and it is therefore impossible for us to set the poles more than two feet out from the building line. On account of this, the fire-escapes, which frequently extend more than four feet from the front of buildings, render about half of the cross-arm on the poles useless, and the wires being close to the metal fire-escapes are therefore also dangerous. Double pole construction with racks across the lanes is forbidden. The question is one entirely of distribution, illumination not entering into consideration at all. Undoubtedly these conditions have arisen in other large cities, and we would like to know what means have been used by other companies to overcome these difficulties.

15—47. What is the power-factor of the magnetizing current of the average standard line transformer, 60 cycles, 2400 volts, of from 5 to 15 kilowatts' capacity? How much has the power-factor been bettered in the past ten years?

16—32. What is the average cost, operating and maintenance, per mean spherical candle-power of the following forms of light during the average life of the appliance? Assume oil at 10 cents per gallon; gas at $1 per M.; electric power at 10 cents per kilowatt-hour.

Kerosene oil, Rochester burner lamp.

Flat-flame Bray burner, 18 candle-power gas light.

Welsbach upright burner, 18 candle-power gas light.

Tungsten lamp, 60-watt size, 1.25 watts per candle-power.

Enclosed arc light.

16—33. We are desirous of having all the information we can get on the subject of series Mazda for street lighting. We desire to know more particularly the prices paid in localities where this form of lighting has been adopted and also would like to have some facts comparing this form of illumination with arc light illumination for residence sections.

17—19. What experience have member companies had with reference to the reliability of underground series incandescent street lighting, using ornamental iron posts? Kindly furnish data and illustrations, if possible.

*19—38. Do member companies experience trouble through installation of starting devices (used in connection with alternating-current motors) which require inordinately high starting current?

What regulations are in force by stations governing amount of current permitted in starting devices?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been es-

pecially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

22—31. What is a fair yearly charge per 16-candle-power lamp for suburban street lighting, the service to be multiple, 118-volt; to include all construction work, lamps, an all-night service, and controlled by a time switch. The company's lines serve the district with residence lighting.

22—33. Is there any company having in operation a flat-rate window-lighting agreement? If so, what is it and how does it work out?

24—31. Inquirer would like information from companies as to whether they attempt the right to cut off for an appliance debt. That is, if purchaser of cooking or heating appliance refuses to pay for same, do you disconnect, same as you would for a current debt?

24—32. We would like to hear from member companies as to their policy and practice in supplying breakdown connections.

24—33. (a) Is there any member company that does not bond its collectors?

(b) On what basis do member companies bond their collectors, i. e., a uniform bond for all collectors, or does bond vary in accordance with conditions of collector's territory?

(c) Do member companies pay for bonding collectors, or are collectors required to pay their own bond premiums?

(d) Do member companies in which collectors are bonded turn the cases over to bond company to settle in case of collector defaulting, or do they settle cases themselves, notwithstanding the fact that collectors are bonded?

(e) Do any member companies have their own bonding fund?

(f) What do member companies that do not have collectors bonded do if collectors should default?

(g) In last ten years how many collectors have defaulted?

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December 19, 1910

CONTENTS

INSURANCE RATES

The Association took up at the St. Louis convention the question of insurance rates on central stations, and resolutions were adopted, on the report of Mr. W. H. Blood, Jr., the insurance expert of the Association, aiming to bring those rates down to a lower and more satisfactory level. It is asserted, and it is believed that the assertion cannot be disputed—that the rates are too high, and should be reduced. The central-station industry is not being treated fairly as a whole, if there is any value in the statistics showing how, with modern methods of improved construction and installation, central stations have become a much safer "risk" than in the past, so that the premiums demanded are not equitable and are out of proportion to the annual loss.

Copies of the resolutions outlining this point of view have now been sent to all Class A members, *i. e.*, operating and holding companies; and a request has also been made that these copies be placed

among the brokers or insurance companies handling their policies. In addition, a letter has been addressed to every fire insurance company. from the office of the Association, with a copy of the resolutions, asking that an investigation of the subject be made, and that a proper reduction be put in force at the earliest possible moment.

Now this is an attempt to secure justice for central-station companies, and to save a good deal of money for them; but it will be much more likely of full success, if each member company will give the matter its direct attention and put the proper pressure in the right quarters. If the cause is just, if the position of the Association is correct, we believe that the insurance companies will at once seek to remove the grounds of complaint. But the insurance companies cannot be blamed if they collect premiums that the central-station companies are willing to go on paying without any remonstrance or objection.

A WORD TO NON-MEMBERS

During the past month the membership committee under the energetic leadership of Mr. H. H. Scott has been busy with a general campaign carried on all over the country and directed at "prospects" in the shape of operating companies that have not yet joined the Association. As your company is not in membership, it is likely that this appeal from a fellow central-station manager, or one deeply interested in the welfare of the industry, has already reached you.

We would now like to ask you whether that appeal has had any effect on you?

If it does not convince you that it is worth while to join your fellow central station men in the Association, what is wrong in the argument? If it does convince you, why don't you join?

In reality, the appeal is addressed to the smaller companies, for practically all the larger companies are in membership. Your dues would be perhaps ten or fifteen dollars a year at the most. Is it not more than possible that the literature of the Association, the special information, the advice to be had direct from one hundred and fifty picked experts on the committees, would return you that amount many times over? What can have brought the Association its present membership but the fact that it makes good every year? What other basis than service rendered could hold over 1,200 corporations in its ranks and increase the number steadily?

That is the merely selfish line of reasoning—good as far as it goes. Don't you want to stand up with your fellows, shoulder to shoulder, for defence, for mutual protection, for dealing with the great questions

that affect the industry, and which if not wisely settled threaten to imperil its prosperity?

Do you want to remain an "isolated plant," cut off from everybody?

If not, start the New Year well with membership in the National Electric Light Association! It will be one of the best things you ever did.

Meeting of Line Construction Committee

Another meeting of the Overhead Line Construction Committee was held on Wednesday, November 30, the members present being Messrs. Vaughan, Paine, Coombs, Sproule, Thomas, Oviatt, Dostal and Osgood; also Mr. Martin Schreiber, who represented the American Electric Railway Association.

The specifications for materials were again reviewed and the text practically completed; and the "Crossing" section of the report was completely covered.

The section of the report covering "Methods of Construction" was well gone into, and made ready for first complete reading at the next meeting.

It is the anticipation of the committee to get the text of the report completed by its first meeting in January, which work will then be followed up by that of the draftsmen, in making a standard set of drawings, which will be put into the report in such form as to serve as working drawings for the field engineers of member companies.

The meeting was called to order at 9:30 A. M. and adjourned at 11:00 P. M. The next meeting of the committee was held at the Association rooms on Wednesday, December 14, at 9:30 A. M., carrying through the day, as usual.

The railway crossing report section of the report was completed and adopted; and considerable advance was made in the general text of the "Methods of Construction" section. A great variety of data, blueprints, line material, etc., has been studied by the committee in its meetings, at first hand. Prof. Albert S. Richey was present, representing the American Electric Railway Association.

The next meeting of the committee will be held at headquarters on December 28 at 9:30 A. M.

He Likes the Bulletin

Professor Edwin J. Houston, of Thomson-Houston fame, whose name is a household word among central-station men, and who has made many valuable contributions to electrical literature, visited headquarters a few days ago, and was handed a copy of the November BULLETIN by the secretary to read on the train to Philadelphia. The following letter was the result:

"I am delighted with the copy of the National Electric Light Association BULLETIN you gave me yesterday, especially with the *Question Box*. I do not remember ever seeing anything more calculated to diffuse the kind of technical-practical information this does. It would be almost impossible to obtain this information elsewhere after long correspondence."

The Company and the Public

On Monday evening, December 5, the Brooklyn Company Section held its third regular meeting of the season. This meeting was memorable for more reasons than one, foremost of these being that the Hon. Edward M. Bassett, member of the Public Service Commission of The First District, State of New York, delivered a remarkably interesting address on the subject of Rapid Transit. Mr. Bassett illustrated his deductions by reference to the work being done in other places in America and in such European cities as have rapid transit problems to solve. In the course of his remarks he said: "Efficiency in a public utility corporation redounds not only to the benefit of the public, but should redound to the benefit of the corporation itself. That saving that comes from thrift, that greater earning capacity that comes from ingenuity and faithfulness, is properly divided between the public and the corporation itself, not forgetting the payment of good wages, and the making of permanent and promising positions for those that contribute to that result.

"I for one am of the opinion that public regulation should incite and increase and encourage private initiative. Thrift, economy, better results for a certain amount of work, more electricity for a certain number of pounds of coal, and that that efficiency should not entirely, or anywhere near entirely, be taken advantage of by the public, but the corporation that can produce results is entitled to a large measure of the benefits of its own efficiency and progress.

"Public regulation will in no sense be a success until that principle is largely recognized, because you cannot make all companies the same. If you try to make all the same it will be pressing down the capacity to the level of the poorest, rather than the raising up or the endeavor to raise up the capacity of all to that of the highest; and profit for the investor, payment of good wages, and the ability to pay good wages to the workmen, must be encouraged by the state, representing all the people."

The papers of the evening were: "Notes on Power Station Economy," by Mr. H. P. Wood, operating engineer of the company, and "Follow-Up System of the Purchasing Department," by Mr. H. Frederick Frasse, purchasing agent. Both papers were received with great attention and

were well discussed. Mr. Wood's paper, which in his absence was presented by Mr. Parker H. Kemble, brought forth several discussions.

The social part of the evening consisted of a fine musical programme by the Ridge Court Orchestra and a number of selections by the Pratt Institute Glee Club, both of which were enthusiastically received and many times encored. The next meeting of the Section is scheduled for January 9.

Argument Against the Private Plant

The National Fire Protection Association, an independent organization whose objects are "to promote the science and improve the methods of fire protection and prevention," calls attention in its October *Quarterly* to the dangers of operating a private plant in a department store. The argument presented is so well worded and of so much value for the electric light solicitor, that it is submitted herewith for the business-getter who is endeavoring to reduce the number of private installations.

"THE POWER PLANT. The size and complexity of this portion of the department store depends wholly on the size, number and character of departments in the store itself. Power plants of the modern department store in the large cites are extremely complete and complex, while the smaller stores may have only boilers for heating the store and pumps for elevators. The equipment of a large modern store comprises, besides boilers, engines with generators and dynamos for electric lighting, and motors for elevators and escalators, water and air pumps for cash-carrier system or elevators, fire pumps, refrigerating machinery run by auxiliary engines for fur storage and perishable goods, artificial ice making, show cases, soda fountains, etc. One does not ordinarily think of these power plants as specially dangerous, but if we stop and consider that here is the source of the entire mechanical energy of the store—that here natural forces are in a state of transformation to other forms of energy—it is readily seen that it is quite essential that all this machinery should be of the best and, above all, be well installed and cared for. As this may not always be the case, the best arrangement, when possible, is to have all such machinery in a separate power building. It is seldom possible, however, that the congested location necessary for the successful department store admits of this. So we are forced to be content with the installation of power plants in the main building, usually in basement or sub-basement. The power room should, in any event, be of fireproof construction and thoroughly cut off from the remainder of the store. This is as much for safety of customers as for fire protection. Boiler explosions are not infrequent in isolated factories, and there is no reason why they may not occur in department stores. The loss of life from a catastrophe of this description is awful to contemplate. Most of the fires reported as occurring in power plants have been of minor importance and due to carelessness of installation or to neglect."

A Practical Basis of Employee Profit-Sharing

The best thought of the industrial world is occupied with the solution of the problems that deal with the relations between capital and labor, particularly along the lines of profit-sharing, pensions and accident insurance or compensation. Some of these topics were dealt with exhaustively in the Public Policy Committee report of this year, of which President Freeman was then chairman. His company, the Brooklyn Edison, of which Mr. Anthony N. Brady is president, has now formulated and published a profit-sharing and pension plan of far-reaching character which has attracted universal attention and deserves the consideration of other operating companies, to which copies of the announcement will gladly be forwarded by this office on request.

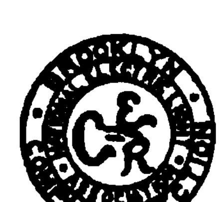
Value of the Index

During the summer months the Association has issued to member companies a copy of the *Index of the Proceedings* of the first twenty-five years, 1885-1909, and its usefulness has been very generally appreciated by those who have the ownership of a set. The *Index* has been very favorably reviewed in the press, and the *Electrical World* in a long notice says: "To the fortunate possessor it will be a prize, and particularly so to public reference libraries containing a set. The *Proceedings* date from the very beginning of the central-station industry, and their pages reflect every step in its technical and commercial evolution. This valuable mine of information, heretofore inaccessible, owing to lack of guidance to its treasure, is now opened in a manner that enables every nugget to be quickly located."

Give and Take

Attention is directed specially to the *Question Box* this month, which occupies over 50 pages in the BULLETIN. There is an amazing variety in the topics, and a splendid outpouring of data and experience from all quarters in response to inquiries. It may seem that the *Box* occupies a good deal of space, yet as an actual matter of fact, nearly 10 pages of matter for it have been held over until next month for lack of space—all of it just as good as that now printed. The *Question Box* is more appreciated than ever, and everybody is studying it with interest.

Section Badges



The Brooklyn Company Section has adopted a badge, a reproduction of which is shown herewith. The Brooklyn Section has been the pioneer in the Company Section badge idea, which is, indeed, typical of its progressiveness. The badge is most attractive in appearance. The outer circle, reading "Brooklyn Company Section," is of white enamel

with gold letters. The inner circle, reading "National Electric Light Association," has a background of navy-blue enamel with gold letters, and the center is of white enamel with gold letters.

As an incentive to prompt payment of dues, the Brooklyn Company Section plans to present one of these badges to each member who pays his 1911 dues during the month of January.

The Philadelphia Section has adopted a handsome badge, which we hope to show next month; and the Eastern New York Section has also just adopted a distinctive emblem badge, different entirely from the other two.

Haverhill Against Municipal Ownership

Progressive central-station management has won public confidence and esteem to such an extent at Haverhill, Mass., that at the recent election a proposition for a municipal plant was defeated by a vote of the people in proportion of about 3½ to 1, the figures being 4780 against 1420. The Haverhill company is one of the public utilities managed by the well-known Tenney Syndicate, of Boston, with which is prominently identified Mr. H. T. Sands, vice-president of our New England Section. The subject of municipal ownership was pretty thoroughly ventilated in the campaign and it was an educated body of voters that went to the polls.

Organization of The Uniform Accounting Committee

A meeting of the Committee on Uniform Accounting was held at the Association rooms on December 12. The Committee is now constituted as follows:

Mr. John L. Bailey, Consolidated Gas, Electric Light and Power Company, Baltimore, Md., Chairman; Mr. H. M. Edwards, New York Edison Company; Mr. E. J. Allegaert, Public Service Electric Co., Newark, N. J.; Mr. E. J. Bowers, Kansas City Electric Light Company; Mr. R. F. Pack, Toronto Electric Light and Power Company; Mr. R. D. Rubright, Edison Electric Illuminating Co., of Brooklyn; Mr. H. R. Lyons, Montreal Light, Heat and Power Company; Mr. L. W. Wallace, Edison Electric Illuminating Co., of Boston; Mr. Geo. E. Claflin, United Electric Securities Co., Boston, Mass.; Mr. C. N. Jelliffe, American Light and Traction Company, New York City.

The Standard Classification of Accounts issued by the Committee has been a great success, and is in constant demand amongst members and from outside sources. A demand has now sprung up for blanks and forms covered by the classification and Chairman Bailey is proposing to deal with that problem among others. It is surprising how many inquiries go to this Committee.

MEMBERSHIP STILL GROWING

The membership of the Association continues to grow in a very satisfactory manner. By the middle of the month it had crossed the 6000 line for the first time, being 6007 on December 15, composed as follows: Class A, 904; Class B, 4133; Class C, 16; Class D, 222; Class E, 722. By way of comparison it is interesting to note that the total membership July 1, 1909, was 3137, and on July 1, 1910, was 5736. The actual growth since the latter date has been much larger than the figures indicate, as the lists have been cleared of nearly 250 members, dropped for various reasons. Herewith is published a new list of 103 included in the above gross total, namely, Class A, 3; Class B, 93; Class D, 1; Class E, 6.

NEW MEMBERS

Class A: Belair Electric Company, Belair, Maryland; Ebensburg Light, Heat & Power Co., Ebensburg, Pa.; Home Gas & Electric Co., Greeley, Colorado.

Class B: Wilmington & Philadelphia Traction Co., Wilmington, Delaware—William F. Kohlbecker, Edward Samuel, Eugene Swarts.

Central Mexico Light & Power Co., Colorado Springs, Colorado—Norman Rowe.

Commonwealth Edison Co., of Chicago, Ill.—William C. Krumbein, Ernest Lunn.

North Shore Electric Co., Chicago, Ill.—H. J. Bloom.

Connecticut River Transmission Co., Boston, Mass.—F. J. Sill.

Gardner Electric Light Co., Gardner, Mass.—Walter A. Belcher.

Public Service Electric Co., Newark, N. J.—William R. Adams, W. H. Chamberlain.

Edison Electric Illuminating Co., Brooklyn, N. Y.—John J. Leslie.

New York Edison Co., New York, N. Y.—Stephen Behan, Joseph H. Bigley, Peter B. Brady, Charles R. Butler, John T. Butler, John V. Bryne, John T. Campbell, B. F. Connolly, James O. Connor, John F. Daley, Peter C. Dolb, Charles S. Dressler, James P. Dunphy, George D. Elserbaum, Colin M. Ferguson, George J. Finn, Julien E. Flannagan, George Ford, Harry L. Gibson, Fred Graf, F. W. Hart, Henry W. Haverstick, George W. Hilliker, Jr., William J. Hogan, Henry T. Holden, Edward L. Holsten, Louis C. Hurrell, W. A. Johnson, Lawrence C. Jones, Eugene Kaufman, George H. Karney, F. J. Lacy, Harry E. Lane, Charles R. Lehmann, Louis G. Long, F. V. Magathaes, George McCardle, Frank Michael, Jr., George N. Moore, John H. Nicktell, David O'Connell, H. F. Odell, James A. Pace, J. A. Pothoff, Frank K. Roberts, Otto L. J. Schler, A. C. Schweizer, S. J. Shaw, S. J. Shiels, Harry G. Shinnerling, Dudley E. Smith, C. L. Spence, August F. Strandt, H. A. Strom, Leland Trask, Ira D. Van Ness, Jean R. Wagner, John L. Wenzel, Fred W. Wiegele.

Niagara, Lockport & Ontario Power Co., Buffalo, N. Y.—J. S. Baum, W. G. Brookins, C. E. Ludlow, E. A. Sevin.

United Electric Light & Power Co., New York, N. Y.—W. H. Addicks, E. W. Finley, J. H. Phair, H. Taylor.

Ottawa Electric Co., Ottawa, Ont.—D. R. Street.

Toronto Electric Light Co., Toronto, Ont.—Malcolm Macmaster, Walter Orme, Ellis Wynne Owen, P. Penitzka, T. J. Smith, E. Clarence Telfer.

Penn Central Light & Power Co.—George P. Roux.

Philadelphia Electric Co., Philadelphia, Penn.—Lewis R. Buckley, Charles Krebs, Robert Stolz, Fred B. Wagner.

Roanoke Railway & Electric Co., Roanoke, Virginia—George C. Miller, Herbert P. Wood.

Class D: Electric Supply Company, Memphis, Tenn.

Class E: Westinghouse Elec. & Mfg. Co., New Orleans, La.—J. C. Walker.

Fred T. Ley Co., Inc., Springfield, Mass.—G. W. Ellis.

New England Telephone & Telegraph Co., Boston, Mass.—H. B. Emery.

Electric Supply Co., Memphis, Tenn.—T. B. Cabell.

General Electric Company, Schenectady, N. Y.—Howell H. Reeves, George Stanton Rose.

NEWS OF THE SECTIONS

THE ENDLESS CHAIN

One of the favorite and at the same time unpopular devices for forwarding a cause is the "endless chain," which consists in making each unit of activity a new center of appeal and publicity. If one person can influence four others, and each of those four more, the results roll up at a rate that has ordinary compound interest thrown into a background of inconsequentiality.

At this moment the Membership Committee of the Association is trying to get every Class A operating company interested in securing other companies as members. Here is a large field of effort, for with nearly 1000 such companies in membership, representing about 90 per cent of the industry, there are about 5000 companies still to be brought in, for their own good. What a splendid field for endeavor of the "endless chain" kind!

All the Company Section members are enrolled in Class B. It is desired to increase that membership also, in an equal or even greater proportion, so that, for example, every Class B Section member would bring in two others, if eligible or available, from his own company. Here is a great opportunity for missionary work, and if a member feels that he is getting benefit from being in our ranks, it is simply public spirit and comradeship to try to bring in some other man. The Membership Committee appeals to all the Class B members for their active support in 1911 in such a campaign.

Activity in the Baltimore Section

The first of a series of ten lectures arranged by the Consolidated Gas, Electric Light and Power Company of Baltimore for its employees was given on November 29 at the Johns Hopkins University. Upon the initiative of the Baltimore Consolidated Section, the company has made arrangements to offer to its employees opportunities for scientific training. The entire expense of the course of lectures to be given this winter is borne by the company, and the lectures are open to all of its employees. The ten lectures will be given by Dr. John B. Whitehead, Professor of Applied Electricity at the Johns Hopkins University. Secretary T. C. Martin appeared before the Section on December 6.

New Officers at Buffalo

The Buffalo Section, which includes the operating companies from Buffalo to Niagara Falls, inclusive, has just held is annual meeting, electing these officers: President, Geo. W. Ames; vice-president, E. A. Le

Fever; recording and corresponding secretary, W. F. Burke; financial secretary, J. M. Hogan; treasurer, M. J. Healy; executive committee, W. R. Huntley, H. B. Alverson, A. S. Allen, F. A. Coupal, Roscoe McMillan.

This is the second year of the Section, and therefore a critical period in its development. The officers propose to put it on a firm and solid foundation, and to boost the Section in all the departments of the companies. A number of interesting meetings have been planned for the coming year.

Meeting in Philadelphia

The November meeting of the Philadelphia Section of the National Electric Light Association was held in the Assembly Room of the Philadelphia Electric Company Building, 1000 Chestnut street, on Monday evening, November 21, 1910. Chairman Meyer called upon Mr. Green, chairman of the membership commitee, to give his report. Mr. Green announced 56 new members, and suggested room for improvement. Chairman Meyer called attention to the 13 reasons set forth by Mr. Green in the last issue of *Current Notes* for becoming a member of the National Electric Light Association.

Mr. Sproule read Mr. Bartlett's report as chairman of the committee on the awarding of prizes. He then referred to the demand for Section emblems, and also announced the formation of three new Section branches—the meter department, the accounting department and the commercial department branch. He stated that in order to receive the 1910 *Proceedings* it was necessary to join the Association before January, 1, 1911, and pay 1910 dues.

Mr. James H. Dentry then read his paper on "The Possibilities of Electricity." It was discussed by Mr. Eglin, who then advised the members to present their papers before December 31, 1910, in order to compete for the Doherty medal.

Mr. G. Bertram Regar read a paper on "The Increasing Prominence of Illuminating Engineering as Recognized by Technical Societies and Universities."

Mr. Sproule read an invitation from the Philadelphia Society of Electric Metermen to attend their next meeting, on December 2, 1910, at 122 Arch street.

Chairman Meyer stated that there were 127 present, and called attention to the fact that at the next meeting, December 19, 1910, the constitution would be considered; also that evening Dr. Spitzka would be present and would address the members on relations between electricity and physiology, especially in relation to shock.

Selling and Rates

The fifteenth regular meeting of the Utah Light and Railway Company Section was held in the com-

pany offices Tuesday, November 22, 1910, at 8:20 P. M., with twelve present. With the unanimous consent of those present Mr. Benj. Bullard presided over the remainder of the meeting.

Mr. Allan Maughan presented a paper on "Rate Making," this being followed by a general discussion of the topic.

Mr. G. B. Walker presented a paper on "The Sale of Electric Power and Light." This subject was also discussed.

Eastern New York Section Organizing

A notable example of the growing recognition of the value of local Sections is shown by the organization for active work on the part of the Eastern New York Section. Plans put in motion some time ago have been consummated by the local executive committee, and appearances now indicate an affiliation of the great body of central station men in Eastern New York into one of the largest and most influential geographical sections of the National Electric Light Association.

The officers of the new Section are: President, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany, N. Y.; vice-president, Mr. M. O. Troy, General Electric Company, Schenectady, N. Y.; treasurer, Mr. T. A. Kenney, Hudson River Electric Power Company, Albany, N. Y.; secretary, Mr. R. H. Carlton, General Electric Company, Schenectady, N. Y.

The executive committee is composed of the following members: Chairman, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany; Mr. C. D. Haskins, General Electric Company, Schenectady; Mr. W. Webb Offutt, Schenectady Illuminating Company (Mohawk Gas Company), Schenectady; Mr. A. A. Anderson, Albany Illuminating Company, Albany; Mr. J. C. De Long, Syracuse Lighting Company, Syracuse; Mr. F. H. Gale, General Electric Company, Schenectady.

An enthusiastic meeting was held at Schenectady on December 13, under the presidency of Mr. Morrow. It was addressed by President Freeman, Secretary Martin, Mr. C. D. Haskins and Mr. W. Webb Offutt. Several new members were enrolled. The Section now has about 150 members.

DENVER DOINGS

On Tuesday evening, November 29, the regular monthly and annual business meeting of the Denver Company Section was held in the Demonstration Hall; President, Mr. G. W. Bixler, presiding. He gave a short talk, telling of a meeting of the programme committee and outlining a programme for the meeting to consist of a thorough discussion of the electric meter, taking up the following subjects, in papers which were then read: "Construction, Testing and Reading of Electric Meters," by H. P. Tewksbury; "Connecting, Handling and Installing of the Electric Meter," by F. A. Tewksbury; "The Taking of Contracts and Orders and Filing of Same," by C. H. Elliott; "Cost of Installation and Maintenance of the Electric Meter," by B. M. Lee; "Review of All Papers," by F. P. Cummings.

Following the programme, officers were elected for the ensuing year: President, F. P. Cummings; vice-president, W. H. Murphy.

Handling Fuel at the Station—
The Coal Dust Twins

Starting off the first business meeting of its fiscal year with an enthusiastic whoop, 210 members of the Commonwealth Edison Section, Chicago, assembled on the evening of December 6th in the rooms of the Western Society of Engineers, to assist in the inauguration of what promises to be the most prosperous and successful year in the history of the Branch.

The meeting was called to order at 8 P. M. and Chairman Smith briefly outlined the plans of the officers and committees, and announced that 130 new members had been enrolled since November 1st. He also dropped a timely hint on the subject of unpaid dues, and urged all delinquent members to get in good standing before the end of the year.

The chairman then announced that Mr. Charles A. Lind would present a paper on the subject of "Purchasing, Transporting and Storing Coal," and that Mr. A. D. Bailey would read a companion paper entitled "Handling Fuel at the Station." At this juncture the two speakers were subjected to a further and wholly unexpected introduction through the medium of the enterprising stereopticon man, who suddenly switched off all the lights and projected a humorous cartoon of Messrs. Lind and Bailey on the screen, representing them in the guise of the "Coal Dust Twins." Mr. Lind's paper described the production, handling and purchasing of fuel from the time that it is mined until it reaches the storage pile, and Mr. Bailey described in detail the various methods of handling coal in generating plants, and the all important part which this commodity plays in the conduct of the electricity supply business. Both papers were admirably presented in plain, non-technical language, and were well illustrated with numerous lantern slides made by Mr. Gerlach.

What proved to be a very popular novelty was then introduced in the form of a ten-minute intermission preceding the discussion of these papers, during which time the members stretched their legs and "milled" around the hall, indulging in a merry gabfest and singing a number of popular songs, assisted by Mr. Lind at the piano. The meeting was then called to order, and an animated discussion ensued in which many of the members took part, including: Messrs. McBride, Bracken, De Clercq, Zankie, Kobick, B. E. Strohm, Rich, Childs, McClure, Dement, W. L. Abbott, Nehan, Fife.

Illumination in Vancouver

At the last meeting of the Section of the British Columbia Electric Railway Company, Limited, Vancouver, B. C., Mr. W. T. Woodroofe presiding, a lecture was delivered by Mr. H. Lauritzen on general and residence lighting. The topic was handled in a masterly manner, and a most valuable body of data was presented as to prismatic shades and reflectors and their correct use in all classes of interior illumination. A most interesting discussion was developed.

Mr. J. A. Vivian Rowe followed with an address on systems of secondary distribution.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at the above address.

Matter intended for publication in any particular issue must be in the hands of the Editor not later than the 28th of the preceding month.

Answers will be published as soon as received.

Since lack of time and space may make some omissions necessary, the Editor reserves the right to publish only what time and space permit, and what in his judgment is for the best interests of the Association. In general, preference will be given to questions over answers, but where it is not possible to publish answers these will be mailed to the member asking the question

The object of the Question Box is to keep members in touch with one another's work and to do it promptly and efficiently.

Suggestions and criticisms tending to improvement are invited.

BETWEEN CONTRACT AND CONNECTION

Following is the text of a letter to the Question Box Editor from Mr. R. S. Hale of Boston:

"On page 134 of the November BULLETIN I notice the answers to question 0-25 with very great interest.

"Apparently, it seems to be considered that a short time between the acceptance of the contract and the installation is creditable in all cases.

"My theory is that this is creditable only in the cases where there is no service loop to be installed.

"On the other hand, if there is a service loop to be installed, a short time between the acceptance of the contract and the installation of the service, indicates that the Sales Department has been very slack.

"If there is no wiring in the house, the Sales Department ought to get track of the matter shortly after the wiring begins and that should give, in the ordinary case, somewhere from a week to six months before the electricity is needed, in the average case probably a month.

"The Sales Department should then secure the contract early and give the department that installs the service ample time to do its work economically and without haste.

"I have been keeping records of the time that has elapsed between acceptance of contract and actual installation, curiously enough having started only a week or two before I saw this question.

"I find our actual average time between the acceptance of the contract and the installation is something like two or three months in the case where service loops are needed.

"I find that our actual average time in the case where service loops are not needed is somewhere in the neighborhood of three or four days, but this includes all the orders. It does not take many

delay orders to bring up average time, and I should think that the great majority of our orders were executed on the day following that on which they were received.

"It would be very interesting to have some other companies get actual figures such as I am getting. There is a great difference between the estimate of anybody and the actual result obtained by taking a large bunch of orders, counting the days that actually elapsed between the acceptance of the order and its installation and averaging."

This subject of time elapsing between dates contract is signed and connection made is of exceeding importance, especially to companies doing a large business. Thousands of dollars have been added by some companies to annual revenue by the saving of from a day to a week in the average time taken, and other companies might with advantage address themselves energetically to a like achievement. Delay means not only loss of revenue, but irritation and annoyance to customers at the very threshold of their relations with the company, and this is, of course, an unfortunate effect, to be avoided if possible.

There are many factors causing lapse of time, all of which are not under the control of or subject to the supervision of the station; also local conditions and requirements vary widely. Nevertheless inter or ultra organization conditions or routines which have been in force long enough to become fixed institutions can frequently be materially improved if considered with respect to what is possible, and without too much veneration for a practice, simply because it is venerable. Every stage an order passes through—delivery by solicitor to office, clerical work, departmental activities covering credit, inspection and the varied features of actual installation, the machinery for facilitation and despatch in securing city permits and fire underwriters or city department certificates—should all be subject to periodic inspection, review, analysis and revision. Even where a system is excellent in all its parts, in a large organization the wheels are likely to become clogged or the workings of the system to deteriorate, every so often, and there is nothing like a periodic overhauling by authority to keep operation up to or above the standard.

In fact, the matter is of such importance in the proper conduct of a large central station that after the house has been set in order, it would seem highly desirable that the general manager or other important executive have submitted to him once a month the entire detail of 25 or 50 orders chosen at random, showing time taken in every division of the work between contract and connection. In this way, knowledge of current conditions would be frequently and automatically presented,

constant supervision be exercised, and the first symptoms of laxity or breakdown in the system be at once discovered and remedied.

TUNGSTEN POLICY IN SMALL CITIES

The propounder of question 24-36 asks whether it is best policy in a city of 28,000, with a station capacity of 1,500 kilowatts, to sell tungsten lamps at list or net prices or to supply them on a free renewal basis. First installation of carbon lamps is charged for and renewals are made free. The present practise is to sell tungsten lamps at list.

Why would not the tungsten policy pursued in practically all large cities where carbon free renewals are given, be equally advisable and advantageous in a city of the size indicated? This is, of course, to sell to free renewal customers at a price which represents cost (including a percentage for breakage and handling) less the cost of the carbon lamp, which would otherwise be supplied without charge.

A station in a 28,000 city with a 1,500 kilowatt equipment has by no means reached the saturation point, and it would seem surely profitable in connection with any active "new-business" movement to encourage in every reasonable way the introduction and use of tungsten lamps. At this late date no argument as to whether the tungsten lamp is an injury or an aid to the electric lighting industry is necessary. Its beneficence has been amply demonstrated. It is an inevitable as death or quarter day. Let the local company lead in the movement and get credit for progressiveness, and the advantage in its community of a reputation for cooperation and liberal dealing.

The questioner also asks "Would it be better to raise our rates one or two cents per kilowatt-hour and then furnish free lamp renewals?"

We would reply to this in the language of *Punch's* famous advice to young people about to be married: "Don't." It is far preferable, if you must, to charge an additional price for the lamps, rather than for the current. Under present average conditions, it is mighty poor policy to try to raise rates. The tendency seems all the other way. A raise inevitably stirs up appeals to legislature or commission, and causes no end of trouble and bad feeling in the community, and this should not be challenged except for reasons of overwhelming importance. The good-will of your clientele is an asset of much value, worth assiduously cultivating, and only to be imperilled as the last resort in a struggle for existence.

ANSWERS

0—21. This inquirer seeks information as to the cities wherein permits are required from city authorities before overhead or underground service may be installed and as to how long it takes to secure such permits?

We petition the Board of Aldermen for permission to make extensions to our line construction where it is necessary to erect new poles and change underground conduits. With the petition we furnish two forms to be filled in by the city clerk, showing action taken by the board upon the petitions. We also file a plan showing the proposed pole locations on the highways, the plan having first been approved by the superintendent of wires and poles and by the street commissioner. Should the board act favorably, upon the petition presented, the city clerk returns to us an attested copy on the form which we furnished with the petition, upon receipt of which notice we proceed with the work under the direction of the superintendent of wires and poles. As soon as possible after receiving notice of the action of the Board of Aldermen, if favorable, we file an acceptance of the grant with the board. For ordinary services and for changes in overhead lines, where it is not necessary to set poles, we simply string our wires under the direction of the superintendent of wires and poles. The Board of Aldermen meets one night in each week.

E. P. Gosling, Superintendent
Old Colony Street Railway Company
Newport, R. I.

Under the terms of the franchise of our company, we have the right to erect, string and maintain wires or excavate and lay conduit, etc., etc., in any of the public streets, places, etc., in the corporate limits of the city; and the work must be done subject to the approval of either the City Electrician or the Commissioner of Public Works, depending entirely upon the character of work done. A blue print is made of the proposed work, and there is never any difficulty in securing immediate approval of both named officials.

M. S. Hart, Manager for Receiver
Consumers' Electric Company
New Orleans, La.

0—23. Please explain how to remagnetise permanent magnets from a 500-volt direct-current source.

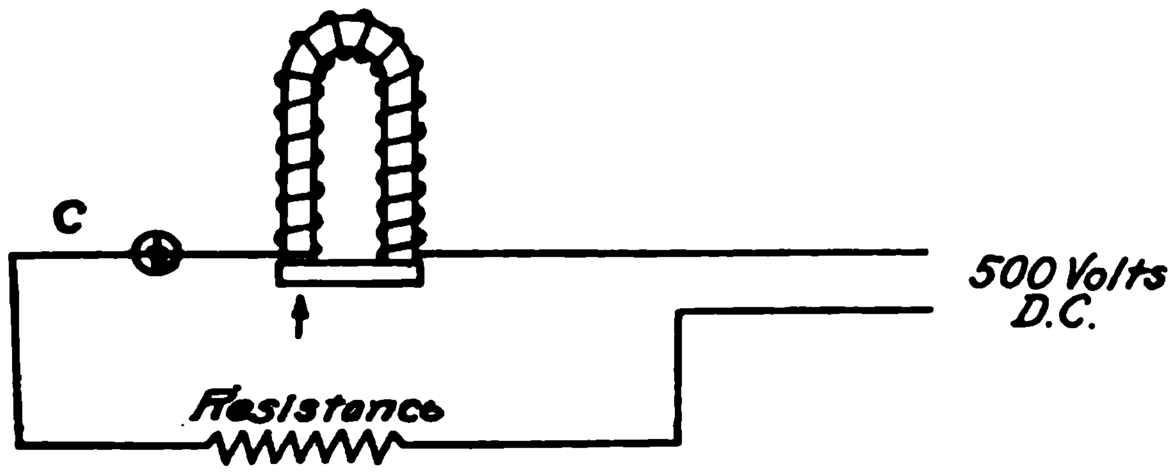
The design of the apparatus would depend on the shape of the magnet, and the number of magnets to be treated, also the length of time allowable for the work.

For only one magnet, of simple form, the best plan would be to wind the wire directly on the magnet.

The number of turns required will depend of course on the cur-

rent capacity of the wire used. Permanent magnets for meters are magnetized on about 15,000 ampere turns, but this treatment is only momentary.

G. C. Cassard
Brooklyn, N. Y.



A wire or cable of suitable size should be wrapped around the magnet and connected to the 500-volt circuit with a resistance to limit the current flow. To diminish the magnetic reluctance, the magnetic circuit should be closed by a keeper, as shown in the figure. I would suggest using at least 300-ampere turns per inch length of the magnetic circuit. The size of wire and the number of turns will depend on the amount of current which may be taken from the line. If 100 amperes, we could use No. 6 or No. 8 wire and wrap three or four turns per inch around the magnet. A bucket of water with a little salt in it may be used to get the proper current. To get the proper direction for winging, first close the circuit so that a compass placed at "C" above the wire will point toward the observer. Find toward which magnet pole the compass points. Begin to wind with this pole and wind in a clockwise direction. The current need not be left on more than a few seconds. It has been stated that it will assist in the magnetizing of hard steel to strike it a few light blows while under the influence of the current.

A. G. Rakestraw
Wilkinsburg, Pa.

0—24. We would like to have information or a list of the cities where ornamental posts with tungsten lamps have been installed for improvement of the business streets, together with the number of lamps utilized.

	No. Posts	Lamps Per Post	Total Lamps
Aberdeen, S. D.	39	5-60 watt	195
Alberthea, Minn.	50	1-40 " 2-60 "	150
*Atlanta, Ga.		5 lights	
**Billings, Mont.	50	2 or 4-40 watt 1-60 "	220 (approx.)
*Buffalo, N. Y.	80	5-60 "	400
Cheyenne, Wyoming	125	5-100 "	525

	No. Posts	Lamps Per Post	Total Lamps
Chicago, Ill.	1,300	mostly 4-60 "	5,200
Columbus, O.	32	5 lights	160
*Dallas, Texas		5 lights	
Davenport, Ia.	48	5-60 watt	240
Dayton, Ohio	300	5-100 "	1,500
Des Moines, Iowa		5-100 "	
Fairbault, Minn.	106	3-40 "	318
Ft. Atkinson, Wis.		3 lights	
Ft. Dodge	70	5-100 watt	350
Ft. Wayne		2-40 " 1-100 "	
Ft. Morgan		2-200 "	
Gary	66	2-60 " 1-100 "	198
	14	4-60 1-100 "	70
Grand Forks	132	4-60 " 1-100 "	660
Grand Rapids, Mich.			60
Great Falls, Mont.	27	5 lights	135
Grinnell, Ia.	128	2-60 watt 1-100 "	184
Cross Point Farms (Mich.)	42	2-75 watt	84
*Hamilton, Ont.		5-100 "	
**Indianapolis, Ind.	200	5-100 "	1,000
Joliet, Ill.		4-600 "	
Kokomo, Ind.		3-100 "	
**Lansing, Mich.	80	3 and 5 lights	350 (abt.)
Lincoln, Neb.	280	4 lights	1,120
Minneapolis, Minn.		5 lights	
Mishiwaka, Ind.		3 and 5 lights	14,000
Mt. Clemens, Mich.		2 or 3-100 watt	
Nashwauk, Minn.	22	1-60 watt 2-40 "	66
Oakland, Cal.	600	10-16 c. p. carbons	6,000
Peru, Ill.	57		
*Racine, Wis.			
Los Angeles, Cal.			
*Rockford, Ill.	200		
Salt Lake City, Utah		4 and 5 lights	
San Diego, Cal		7-16 c. p. carbons	
*Sandusky, O.	78		
San Francisco, Cal.	140		
Savannah, Ga.		3 or 5-100 watt	
Sherman, Texas.			

	No. Posts	Lamps Per Post	Total Lamps
South Bend, Ind.	40	4-50 watt 1-160 "	200
*Spencer, Ia.	28		
Superior, Wis.		1-40 " 2-100 "	
Syracuse, N. Y.		5 lights	
Terre Haute, Ind.		5-100 watt	
Van Couver		5-75 "	
Victoria, B. C.			
Virginia, Minn.	50	5 lights	250
Washington, D. C.		1 light	
*Wasau, Wis.	100		
Winterset, Ia.	39	4-40 watt 1-60 "	195

*System proposed or recently installed.

**System to be extended.

NOTE: A large number of these installations are being extended and new installations are being put up in cities all over the country as a glance at recent electrical publications will show.

A. A. Pergande
National Electric Lamp Association
Cleveland, Ohio.

O—25. Will member companies give figures as to the period of time elapsing between acceptance of contract, and actual installation of service?

This depends largely on customers, who very frequently make contracts before they have their wiring completed or even have the building built. Line extensions are sometimes necessary. The average for a certain period of several months, taking all jobs, was nine working days from the date the contract was accepted, until lines and meters were in ready for service. Of this, six days of the delay was entirely due to the customer not being ready for the company to do its work. Ordinarily the company will give service complete in two days and on special cases, one day.

E. A. Le Fever
Buffalo General Electric Company
Buffalo, N. Y.

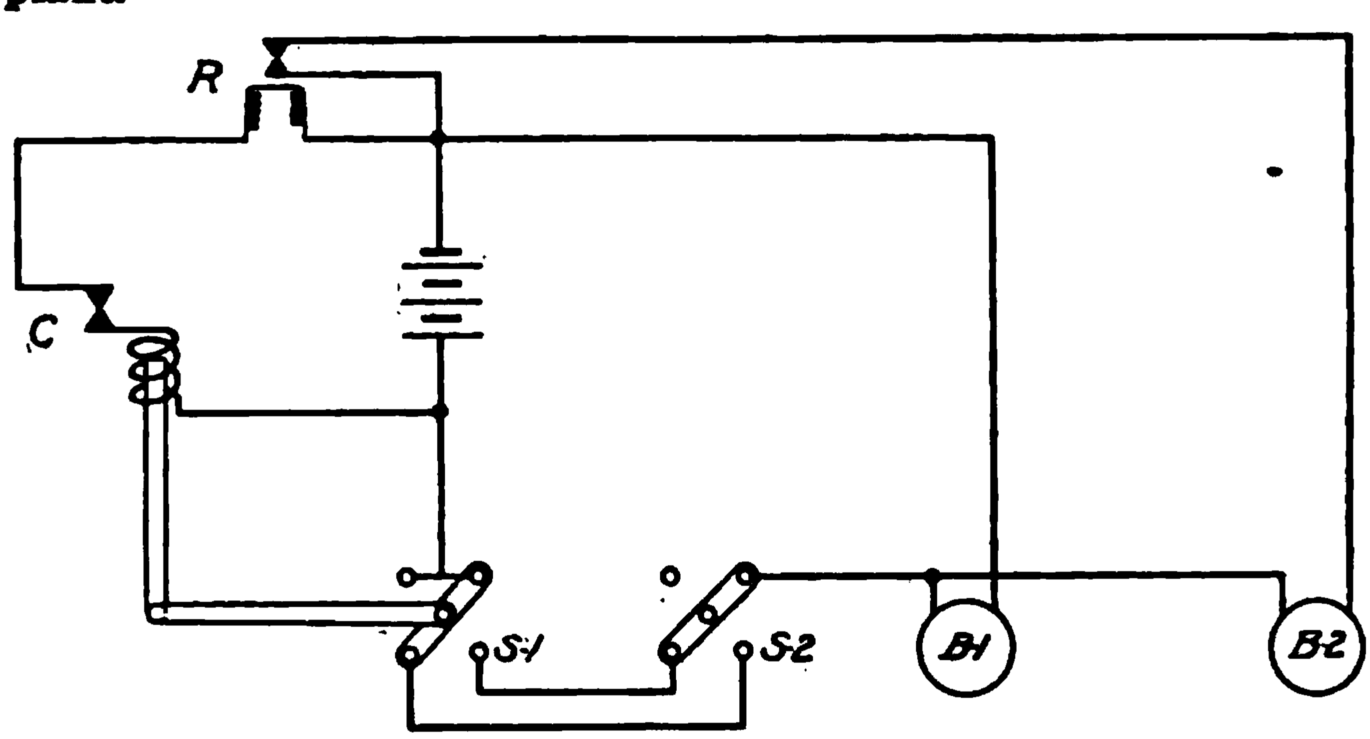
In our overhead district where no extensions are necessary, the *only* work being the placing of transformer and running taps, four to five days is our average time. In our underground district, where laterals have to be installed from a manhole, this time is increased to about a week. Where meters and lamps only are to be installed, our average time is two days.

E. R. Davenport
Providence, R. I.

The length of time which elapses between acceptance of contract and actual installation of service varies considerably with the conditions of the contract and whether we have necessary poles and lines close to the consumer so that connections can be easily made. Our contract reads that it can be accepted by the company in two ways, either by writing, or by the installation of the company's meter and the attaching of the wires to the consumer's premises. As most of our contracts are accepted in the second manner, it will be noted that there is absolutely no loss of time between the acceptance of the contract and the actual installation of service as the same occurs simultaneously. On the other hand if a contract be accepted in the former manner and it is necessary for the company to set poles in order to reach the consumer, a period of thirty days may elapse, owing to the fact that the city has to be given notification if any new poles have to be set; and unless they locate the same for us, we have to wait 30 days before proceeding with the work. Generally speaking, the period which elapses from the time that the consumer's installation is ready for connection until the connection is made is from twelve to twenty-four hours.

P. T. Davies
Montreal.

0—26. At our power station there is but one man on duty at a time, there being two shifts of twelve hours each. We have had occasions where night men went to sleep on duty. A watchman's clock would meet this condition, but we wish to protect both the man and ourselves against the possibility of his being disabled and unable to 'phone or turn in an alarm. Several hours might elapse before conditions became known, possibly losing the man his life and ruining the plant.



C = Clock contact
R = Circuit opening relay
S-1, S-2 Three way snap switches
B1, B2 Alarm bells

Required—an automatic system registering in half-hour or one-hour periods which would give an alarm either by whistle at plant

or bell at distant point should the attendant not be present at the predetermined time to prevent its alarm. As the man has other duties and it might be impossible for him to be there just on the minute, such device should give him at least five minutes' warning, but should also be of such construction that he couldn't tamper with it to prevent its action for periods in advance, allowing him to cut it out entirely for several hours. It should thus answer the purpose both of a watchman's time-detector and a safety device.

Is there such a device on the market or any station where such a method or something similar is in use?

Such an apparatus can be made as shown in the accompanying diagram. C is a contact attached to the movement of a striking clock, so that the circuit is normally open but closed when the clock "warns." B-1 and B-2 are alarm bells; S-1 and S-2, three-way snap switches; and R, an open-circuiting relay. B-1 is located in the engine room and B-2 at some distant point. The clock C controls a solenoid which operates S-1 through a ratchet mechanism. S-2 is thrown by the engineer when warned by B-1. The relay cuts out B-2 during this period. B-1 rings when the clock "warns," and B-2 when it strikes, unless S-2 is thrown by the engineer.

The engineer can ring B-2 at any other time by throwing S-2.

William M. Joy
Milldale, Conn.

An electrically operated watchman's clock located at a distant point from the plant would show the presence of the attendant at regular intervals, but it must be located where some person would notice its failure to indicate the presence of the attendant, and visit the plant to ascertain the cause. The attendant could instruct some person to ring the clock who would not be capable of properly taking care of the plant, leaving the system unreliable. Any device placed in the station would be of no value, as the attendant in a short time would be able to prevent or give a signal and at the same time be asleep or away from the station.

The writer suggests installing a device similar to a voltmeter at a point distant from the station. This device should be made to indicate the variation in voltage, say from three to four volts, either high or low from the normal voltage. The divisions can be made fairly large, thereby decreasing the sensitiveness of the device. Should the pressure vary the limit, the pointer can be made to close a circuit and operate a small motor on a battery. This motor by proper gearing could be made to operate a bell, should the voltage remain either high or low, say for five minutes. This system would tend to keep the pressure normal, which of course requires the attention of the station man.

F. L. Leitner
Brooklyn, N. Y.

O—27. How does the conductivity of air vary with the pressure?

In common with all true gases the dielectric strength or puncturing voltage of dry air varies with its density. At atmospheric pressure, which is equal to about 760 m.m. of mercury, air offers considerable resistance to puncture in accordance with well established relations between voltage, character of electrodes and their distance apart. At lower pressures, down to a critical point which varies in different gases, the puncturing voltage gradually decreases, reaching a minimum in air at about 1 m.m. of mercury. If the pressure is still further reduced, the puncturing voltage increases again until at a point of very high exhaustion—say one millionth of an atmosphere, corresponding to about .00076 m.m. of mercury, it exceeds that of dry air at atmospheric density. This feature may be often observed in X-ray tubes when high tension sparks will sometimes jump through air across the coil terminals rather than pass a shorter distance between the electrodes inside the exhausted tube. When the atmospheric density of dry air is increased by artificial pressure its resistance to puncture increases.

W. S. Andrews
Schenectady, N. Y.

0—28. Please give information as to any firm manufacturing appliance or using electricity for cutting trees of such large diameter that they cannot be sawed. The idea is to use a transformer delivering a heavy current at a low potential to heat a wire or suitable conductor to press against the tree and burn its way through.

Several years ago a number of tests were made at the Schenectady works of the General Electric Company to determine the feasibility of cutting off tree trunks by means of an electrically heated wire. It was found that with no endwise movement of the wire the cutting effect was very small. With a sawing motion some cutting was effected but the wire frequently burned off outside the wood when the temperature was high enough to be effective. Power had to be applied to work the wire and very little tension or pressure could be sustained by the white hot wire. As far as we can learn there is no firm building such apparatus.

A recent German invention which appears to be successful is made up of a long endless wire belt of about .040 inches diameter, and running at about 12,000 feet per minute. This belt is driven by a high speed electric motor and is supported at the other end by an idler pulley. This wire when applied to a tree trunk immediately heats the line of contact to the charring point and strips out the charred wood, thus progressing through the trunk. By this means, a tree 20 inches in diameter can be cut down in six minutes without actually heating the wire itself. By means of this system trees can be cut off flush with the ground, thereby saving wood and leaving the ground unobstructed by stumps.

Robert H. Rogers
Power and Mining Engineering Department
General Electric Company
Schenectady, N. Y.

[In a recent issue of the *Literary Digest* under caption "Felling Trees With Wire," a short description of the German invention mentioned by Mr. Rogers, is given as an extract from the French magazine *Cosmos*, (Paris, Sept. 17th). The process is described substantially as Mr. Rogers describes it, and the name of the inventor is given as Hugo Gautke of Berlin—Editor.]

Q—29. Horses, as is well known, are very susceptible to electric shocks; yet, how can the following cases, and especially No. 3, be explained?

(1) Horses passing a certain point on a street over which street railway rails were laid, had been noticed to show evidences of being shocked, and in some cases were thrown to the street. Is the explanation that there must have been a poor bond at the point, and that the horses touched one rail with a forefoot and the other rail with a hindfoot? Is this a satisfactory explanation and is there any other?

(2) On a pole carrying both telephone and electric light wires, telephone on top, a pair of 2300-volt, 60-cycle wires carried down the pole, rubber insulation, and thence in iron pipe underground across the street to transformers located inside a building; cobble-stone pavement on street; on numerous occasions, especially when pavement was wet, horses hitched to this pole apparently received shocks when coming in contact with the pipe carrying the wires. Ordinarily, made horses jump back. Possibly one or two may have been thrown to the ground. One horse was finally killed by a shock at this point. This was during a rain storm and some thunder and lightning, and there is reason to believe that some lightning disturbances came to the pole over the telephone wires, as the telephone people were troubled by lightning about the time the horse was killed. If a lightning discharge of some kind is the explanation, it does not explain the other shocks, and why was not the iron pipe a better conductor to the ground than the horse's body, thus preventing any shock to the horse?

(3) A pair of 220-volt wires were carried in rubber insulation and in an iron pipe under a plain dirt road, the pipe being buried about two feet below the surface. The wires were fused on a pole adjoining. The insulation was apparently in pretty good condition, although there was leakage from one of the wires. Horses passing this point, especially when the road was wet, jumped and otherwise gave evidence of receiving shocks. Finally, one horse, when the road was wet, stopped when he came directly over the underground pipe, fell with his head between his front legs, and died within a few minutes. How can shocks be transmitted from the earth to animals under the circumstances above indicated?

1. The only safe conclusion in the absence of further evidence is that the horses referred to, spanned a potential difference of say 10

volts, or more, between their different feet; 10 volts applied between the fore and hind legs of a standing horse by allowing him to stand on one iron plate with his fore legs and another iron plate with his hind legs, have been found to be ample in many cases to agitate the horse very visibly. An imperfect rail bond might give rise to such a difference of potential in the neighboring regions of pavement or soil on which the horse trod. It would, however, be possible, in some cases, to produce this difference of potential with perfect rail bonds in the case where the track happened to have a potential of 10 volts above or below the neighboring ground.

2. Assuming that a lightning discharge is not sufficient explanation, the reason should be looked for in a distribution of electric potential over the surface of the ground. A heavy flow of alternating current escaping from a faulty conductor may readily establish a gradient of potential of 50 volts radiating from the fault outwards in roughly concentric circles to zero at a considerable distance. If a horse bridges with his body two zones differing by say 10 volts, he may be shocked very evidently. Just how many volts are needed depends on the kind of horse, his age, the conditions of his shoeing, the wetness or dryness of his feet, and whether the current is A. C. or D. C.

3. Horses are very susceptible to shock and are much more easily killed by electric shocks than human beings, according to experiments that have been made with quadrupeds. They are particularly susceptible to alternating currents. A leakage through and over the surface of the ground may produce sufficient difference of potential in the mass of the ground, owing to imperfect conductivity, to produce severe shocks.

A. E. Kennelly
Professor of Electrical Engineering
Harvard University
Cambridge, Mass.

0—80. This company desires at once any statistics which have been compiled and which are ready to access of the various charges and costs of ornamental street lighting systems which are being maintained in the various cities of the country.

To be of any use, this information must be received promptly.

Display illumination in our city is very popular. All of this type of work was solicited for by the merchants themselves, formed in groups or societies for the purpose of the betterment of their business. This system of light, as well as the general street illumination is done with a luminous magnetite four-ampere arc light, 50 in series to the circuit, there being a total of approximately 2,500 lamps covering an area of 49 square miles.

The following table is compiled in a condensed form for the convenience of those who are interested in street arc lighting of this nature:

Series Luminous Magnetite Arc Lamps, cost each..	$ 23.65
Ornamental Iron Lamp Posts	45.00
Complete cost of construction:	
Series system per lamp installed	106.00
Multiple system per lamp installed	85.00
Total maintenance cost per year	6.30
Cost of mercury arc tubes per lamp per year	3.81
Average life of rectifier tubes	890 hours
Average life of lower electrode	170 "
Average life of upper electrode	2 years

W. E. Richards
Toledo Railways and Light Company,
Toledo, Ohio.

We are using a cast iron standard with 4-40 watt tungsten lamps suspended and one 100-watt tungsten lamp in inverted position.

Lights burn from dusk until midnight, 365 days per year.

Number of poles installed, 169.

Lamps per pole (100-watt tungsten), 5.

Average spacing of poles, 80 feet.

Average life of lamps, 800 hours.

Average income, 7 cents per foot per month.

Breakage of outer globes less than one per cent per month.

We install and maintain the equipment and collect from the merchants on a frontage basis.

Indianapolis Light and Heat Company
T. A. Wynne, Vice-President
Indianapolis, Ind.

12—85. We wish to learn what satisfactory or unsatisfactory operating experience member companies have had in serving villages and farms from small transformers placed on 10,000 to 15,000-volt lines.

We have a number of instances on our system where small communities are supplied from our 13,000-volt distributing lines. In each case we have placed transformers out-doors, the transformers being specially designed for out-door service and deliver current to the towns at 2,300 volts. In no case have we done this for an individual customer, although if his demand is large enough to justify it, there is no reason why it should not be done.

Connecticut River Transmission Company
E. J. Richards, General Superintendent
Fitchburg, Mass.

12—86. Our experience has been in case of lightning storms that we have lost transformers close to poor grounded lightning arresters and have not lost a like make of transformer on the same line, but a mile or so away from any arrester, and this leads us to

ask the following question: When pole line lightning arresters are properly installed in every way with the exception of the grounding, and that proves to be poor, or the ground wire broken, are such arresters a detriment rather than a protection to the line?

So far, the best lightning arresters one can purchase are not wholly reliable, and unless properly installed generally prove a detriment.

J. H. Enright, Manager
Frederick Gas and Electric Company
Frederick, Maryland

It is probable that the type of lightning arrester referred to is the multiple gap with shunt resistances. A poorly grounded arrester is, by virtue of its increased resistance to ground, unable to carry away the charge quickly enough to prevent an abnormal rise in potential at or near the arrester.

If the rise is sufficiently great, the potential of the line wires above the earth may be of such magnitude as to cause a break-down of the insulation of the transformer from primary to ground. This excessive rise in potential would probably extend only a short distance along the line before being discharged, and other transformers would not be seriously affected by it.

A. H. Timmerman
Chief Engineer, Wagner Electric Manufacturing Company
St. Louis, Mo.

12—37. What success have member companies operating above 33,000 volts had with a telephone line attached to the poles or towers?

(a) On what length of line?

(b) What is the clearance between the power and telephone wires?

(c) Is the line transposed? If so, how often?

(d) What style of apparatus is used?

We have one line in successful operation, which is run on the same poles as our 44,000 volt transmission lines for a distance of 69 miles and is continued for an additional distance of 25 miles on a separate line of poles placed approximately 25 feet from the steel tower line which carries the high voltage conductors. These telephone wires are transposed at every second pole and are 9 feet below the cross arm carrying the high voltage conductors. The telephone conductors are of No. 8 and No. 10 iron wire. The insulators used on telephone lines are ordinary 2300 volt porcelain insulators, similar to the Thomas No. 1,013. This line gives us very good service, but the slightest ground will put it out of commission, as the potential induced on it by the main power wires is pretty high.

We have a number of shorter lines similar to the above in commission and find very little difficulty in operating the phones, pro-

vided the telephone wires are kept at all points a sufficient distance below the main conductors. We are using Sumter Phones, Stromberg-Carlson and Western Electric Phones, all of which are giving fair satisfaction; but none of them are insulated heavy enough to stand the potential that we sometimes get on these lines.

Southern Power Company
Charles I. Burkholder, Manager Operating Department
Charlotte, N. C.

We are operating a telephone line on a 33,000-volt transmission line. The length of the line is approximately 55 miles; distance of telephone wires from the transmission wires 9 feet.

The telephone wires are transposed every 440 feet. The line gives very little trouble, and is very clear. The Kellogg switchboard and apparatus is used.

The writer has had some experience in the construction of a telephone line in conjunction with the 100,000 volt transmission line of the Great Western Power Company. The length of their line is 155 miles; the telephone wires are strung on a steel messenger wire, which is strung from tower to tower. The spacing of their towers is 750 feet. The telephone wires are transposed at each tower.

That line, when installed, gave splendid service, with very little noise.

Ventura County Power Company
F. W. Hunter, General Manager
Oxnard, California

We are operating a transmission line with initial voltage 75,000, length of line 118 miles, three-phase, transformers connected in "Y"; steel towers throughout the whole length; average span 700 feet, two circuits 4/0 copper. This line has been in operation three years, during which time we have operated and are now operating a telephone line, supported on the same towers, the wire being likewise supported between spans on small wooden poles, and the operation of the line is very successful. We have had very few troubles. Conversation can be carried on between our general office and the station, a distance of 120 miles, just as clearly as though the operator were in the next room, except of course during times of transmission trouble.

(a) Length of time, 118 miles.

(b) Clearance between tower and telephone wires 6 feet at center of span and 8 feet at tower.

(c) The telephone wires are transposed on every tower.

(d) The apparatus used is Standard Kellogg phones, with our own relays, and lightning arresters.

Southern California Edison Company
B. F. Pearson, General Superintendent
Los Angeles, California

Telephone lines attached to poles or towers carrying the high voltage wires have not been depended upon for the important service in connection with the operation of this system. Ordinarily, conversation can be carried on over such lines for distances up to 100, or, possibly 150 miles, but cannot always be considered reliable, on account of their becoming inoperative during times of trouble on the transmission circuits. They have, therefore, been used more especially for local purposes, rather than for service between generating and important distributing centers. The clearance between power and telephone wires has been kept as great as possible, but in no case has it been allowed to be nearer than 4½ or 5 feet from 60,000-volt circuits. The oftener the telephone line is transposed, the better. Generally these transpositions are made about every one-half mile. The ordinary high resistant bridging phone is used, connected directly to the line without fuses. As a protection against high voltages on the telephone line induced from the power circuit, small carbon lightning arresters are used. These consist of carbon plates about 1¼ x 2 x 5/16 inch thick, the two plates being separated by about 1/32 inch, one being grounded, the other connected to the line. With this small separation of plates, any high potential induced on the telephone circuit will cause a break-down across the air space and ground the circuit in most cases before damage is done to the instrument. In using phones connected to these lines, an operator is always required to thoroughly insulate himself from the ground.

P. M. Downing, Engineer
Pacific Gas and Electric Company
San Francisco, Cal.

We are operating a private telephone line on a 70 mile, 66,000 volt steel tower transmission line with perfect success. The telephone lines are located about six feet below the power wires and are transposed at every other tower, an average distance of 700 feet. We experienced considerable difficulty at first in the burning out of bells, repeating coils, etc., when serious disturbances occurred on the power circuits, but, by the proper location of drainage coils, (Western Electric 37-A coils), which are connected across the telephone line with the middle point of the winding grounded and the installation of aluminum cell lightning arresters on the telephone line, we have practically eliminated all trouble from burn outs. The drainage coils are located at intervals of about 10 miles and the aluminum cells, which also act to discharge excessive voltage, are placed at both ends of the line and at every sub-station. A number of Argus arresters (Western Electric) were originally placed on the line, but proved to be a source of trouble and were removed and their style No. 86-A, carbon block protector, was substituted in every instance. Five ampere, double pole fuses are placed in the leads to all telephones and drainage coils and it is now an unusual thing for our telephone line to be out of service.

Western Electric 12-A telephone instruments are used and about 12 instruments are bridged across the line.

Connecticut River Transmission Company
E. J. Richards, General Superintendent
Fitchburg, Mass.

We have had very successful operation with a telephone line attached to cedar poles underneath a 44,000 volt transmission line. The length of the line is approximately twenty-seven miles. There is a distance of about twelve feet between the telephone line and the bottom two wires of the transmission line. The telephone line is transposed continuously, the two wires making a twisted pair. The transmission line is transposed four times in the twenty-seven miles. The telephone line is built of No. 9 galvanized iron wire supported on pony insulators which are attached to iron pins driven into holes drilled in the poles. The line is cut into eight sections for testing purposes by means of strain insulators inserted in the line and detachable jumpers are put across the test points. The telephone line is terminated with two General Electric high tension 1-1 telephone transformers. The telephones are installed on the secondary side of these transformers. The telephones are of the ordinary magneto type and are not specially insulated owing to the fact that the instrument side of the telephone transformers is grounded. If there is a ground on the transmission line the telephone line is too noisy to use.

P. T. Davies
Montreal.

15—47. What is the power-factor of the magnetizing current of the average standard line transformer, 60 cycles, 2400 volts, of from 5 to 15 kilowatts' capacity? How much has the power-factor been bettered in the past ten years?

Considering the standard 2,400-volt transformers built by a prominent manufacturer ten years ago, the average core loss of sizes 5 to 15 KVA was 1.36 per cent and the average exciting current was 2.02 per cent, giving a power-factor of about .67. In the transformer of to-day, the core loss has been reduced to .8 per cent, while the exciting current has remained about the same, being now 2 per cent, giving a power-factor of .4. It will be noted that this reduction in power-factor is due not to an increase in the exciting current but to the enormous reduction in the core loss, *i. e.*, in the energy component of the exciting current, which has been secured during the period.

E. C. Hall
General Electric Company
Schenectady, N. Y.

The power-factor of the exciting current of a standard line of transformers for 60 cycle, 2,400-volt circuit varies from 0.2 to 0.45. Transformers built five or ten years ago would have shown a power

factor of the exciting current of from 0.5 to 0.8, depending upon the induction at which the iron was worked. In other words, the power-factor of the exciting current has been decreased rather than increased during the past ten years. This is due to the fact that Silicon steel which is in use to-day has a lower permeability and is worked at higher inductions than the steel formerly used. Besides this, the core loss of transformers has been considerably reduced, practically cut in two within the last ten years. In other words, although the power-factor of the exciting current has dropped to one-half of its previous value, the core loss has also dropped the same amount, with the result that the actual value of the exciting current remains approximately the same.

A. H. Timmerman

Wagner Electric Manufacturing Company

St. Louis, Mo.

In making accurate research tests on transformers of various reputable makes, the writer has found that the power-factor of the no load magnetizing current varies between 35 and 75 per cent. in the 10-kilowatt sizes. These transformers though the power-factor of the magnetizing current varies so widely at no load, show about the same full load characteristics in voltage regulation and efficiency. Ten years ago, probably no commercial transformer of this size had a magnetizing current power-factor greater than 60 per cent.

D. & W. Fuse Company

Ralph C. Patton, Electrical Engineer

Providence, R. I.

15—51. Have member companies found mercury alarm contacts on thermometers used on transformers reliable?

What other device for giving an alarm in case of excessive heating has been tried?

Mercury thermometers with alarm contacts are generally furnished with oil-insulated, water-cooled transformers. These contacts are generally arranged to give an alarm when the oil reaches a temperature of 75 degrees Centigrade and can be depended upon to be correct within 3 degrees. In installing the alarm, care should be taken to choose one that requires as little current as possible and the battery should not be any larger than is necessary to operate the alarm. Too much current passing through the mercury contacts will injure the thermometer. We know of no other satisfactory device for accomplishing the same purpose.

W. M. M'Conahey

Westinghouse Electric and Manufacturing Company

Pittsburg, Pa.

Bell alarm contact thermometers are used on all our high-tension, water-cooled, transformers and are set to operate at 55 degrees Centigrade and in over a year's operation, there has been no failure to indicate, although under normal operation, we do not allow the temperature to reach this point, and from time to time we test these thermometers out to see that they are in working order. Our experience indicates that they are a success.

Connecticut River Transmission Company
E. J. Richards, General Superintendent
Fitchburg, Mass.

The Rochester Railway and Light Company uses the mercury alarm contacts on the thermometers on three 1,000-kilowatt transformers. These are found to be reliable, and no trouble has been experienced. Similar devices are used on the 5,000-kilowatt transformers now being operated by the Connecticut River Power Company of Vernon, Vermont. The General Electric Company has used a fusible link in the case of air-blast transformers, the link being so arranged as to support a weight which, when the link melts, will close the dampers in the top of the transformers, thus shutting off the air supply and making contact so as to ring an alarm bell near the switchboard.

J. D. Whittemore
Rochester, N. Y.

We have built a large number of power transformers with mercury alarm contacts on the thermometers, and up to this time have had no complaint from customers as to unsatisfactory operation. We should, therefore, judge that this type of device is proving successful in operation.

A. H. Timmerman
Wagner Electric Manufacturing Company
St. Louis, Mo.

16—31. Is it worth while to use low-voltage tungsten lamps for signs, or is the improvement in high-voltage likely to make the transformer expense unjustifiable?

I do not consider it worth while to use low voltage tungsten lamps, purchasing transformers for lowering the voltage, for electric sign work.

I do not consider it worth while to use low-voltage tungsten lamps in series on a 110-volt circuit, operating the same at an efficiency of 1½ watts per candle. The lamps should be closely assorted as to candle power which will assure long life.

This I consider the proper procedure pending the advent of low candle-power high-voltage lamps which at present are not in sight.

R. W. Rollins
Hartford Electric Light Company
Hartford, Conn.

The specific resistance of the metal tungsten is very low, and in order to obtain small wattages or high resistance, the filament must be made very long and very fine. The minimum commercial limit on the wattage of Mazda lamps for 100-125 is 25. In order to obtain small candle powers required for signs, it has been necessary to use heavy filaments of low voltages, thereby obtaining a rugged lamp and one which, on account of its short filament, could be made up with a small bulb of the same size as the carbon sign lamp. This heavy filament makes possible a lamp of very much longer life than one with fine filament, at the same efficiency.

C. W. Bettcher
General Electric Company
Harrison, N. J.

Although the 110-volt tungsten lamp has been improved greatly in the matter of efficiency and durability, it is not yet practicable to manufacture a mechanically strong filament of low enough candle power for ordinary sign lighting using this voltage. The smallest 110-volt tungsten filament lamp now in general use is the 25-watt size giving approximately 20 candle-power, evidently too large a unit for sign lighting.

In the low voltages, however, the tungsten filament lamp can be made in smaller and more suitable sizes. The lamp commonly employed for sign lighting is rated at 5 watts and burns on 10-13 volt-circuits giving 3.8 horizontal candle-power.

If it is desirable to operate these lamps directly on 100-volt circuits, and thus eliminate the use of a transformer, the sign can be wired up in series or in series multiple. However, if a transformer is used, less trouble is likely to arise when lamps burn out.

A. E. Lennox
National Electric Lamp Association
Cleveland, Ohio

16—33. We are desirous of having all the information we can get on the subject of series Mazda for street lighting. We desire to know more particularly the prices paid in localities where this form of lighting has been adopted and also would like to have some facts comparing this form of illumination with arc light illumination for residence sections.

General information on street lighting by Mazda series lamps can be obtained from the street lighting bulletins of various incandescent lamp companies.

The Mazda street series system is better adapted for the lighting of residence districts than the arc lamps, due to the fact that the lamps can be spaced closer together and can be hung lower.

In residence districts the light units are generally spaced far apart, since the appropriation for this class of lighting is usually small. Hence arc lamps are frequently spaced two or three blocks apart. The result is that there is a comparatively high illumination

under the lamps, while a large space between the lamps receives little or no illumination. Mazda units of the 75-watt or 100-watt type can be spaced closer together, since several of these units will replace an arc lamp at the same cost. The resultant illumination will be much more uniform. Furthermore, in residence districts the sidewalks are often lined with trees which cut off considerable light from arc lamps hung at a height of probably 20 feet. Mazda units can be hung at such heights that they will be below the shade trees.

The improvement in illumination on a street can be seen from the following data taken from the "Trans. of I. E. S., June, 1910, by C. O. Baker":

"Direct current 6.6 amperes enclosed arc lamps were placed 400 feet apart, 21 feet above street level. Measurements were taken over a distance 200 feet each of lamps and 14 feet out from the lamp line. Maximum foot-candles was 0.185, minimum 0.003 and average 0.0475.

"Three 100-watt Mazda with flat fluted reflectors spaced 150 feet would cover about the same distance. The illumination under these conditions gives maximum of 0.205, minimum of .006 and an average of 0.063 foot-candles. Measurements for Mazda are all higher and there is less variation from the mean. The average variation in the arc system from the mean was 106.9 per cent; for the tungsten was 33 per cent—much more uniform."

Two 100-watt Mazda lamps would probably give an illumination equivalent to and more uniform than that of the carbon arc above mentioned. As a general estimate on the comparative cost of the systems, it would be safe to say that five 100-watt Mazda lamps could replace two carbon arcs and the total cost of maintenance, operation and fixed charges would be about the same. However, the wattage of the Mazda system would only be about half that of the arc system and hence with the Mazda units the street lighting system could be extended considerably, without increasing the capacity of the generating apparatus and transformers at the central station. This fact has been taken advantage of by central stations which have had their apparatus fully loaded when extensions in the street lighting system were necessary.

A. A. Pergande
National Electric Lamp Association
Cleveland, Ohio

The city pays us $16.00 per year for a 40-watt lamp on a 4,000-hour schedule. There are 375 lamps installed. The illumination from incandescent lamps in residence sections with many shade trees is superior to that from arcs, with the same expenditure of energy per mile of street.

Laurent Heaton
Middletown, N. Y.

fass., we have removed practically all of the arc
ıblic highways and substituted 75-watt tungstens.
The general illumination has been very materially
a few arcs remain in the public squares. I would
orrespondent obtain copies of the State Commission's
prices of street lighting in various cities.

Connecticut River Transmission Company
E. J. Richards, General Superintendent
Fitchburg, Mass.

We are using 55 4-ampere 40-watt series tungstens on two 4-ampere series luminous arc systems in Menominee, Michigan. We receive $15.00 per year per lamp for this service, burning on all night moonlight schedule, or approximately 2,750 hours per year.

W. R. Putnam
Marinette, Wis.

17—28. Will some one suggest an efficient method of lighting moving picture studios which shall also be economical? Lighting must be shadowless and permit instantaneous photography. Reflectors shooting sharp rays of light cannot be used. Size of studio, 15 feet wide, running in length from 12 to 17 feet. Height 8 feet. Present system uses arc lighting of 700 amperes at 110 volts, cost $12,000 to install and is very expensive to use. Tube lighting has been tried and found wanting. It possesses actinic properties but is not sufficiently concentrated. This is a growing class of business and will repay some study.

(See last month's BULLETIN for other answers.)

The whole question of lighting a studio used for instantaneous photography, is a broad one and far too specialized to supply an adequate answer in the *Question Box*, where brevity is essential. The statement is made that the lighting must be shadowless—an error—for without shadows, giving rise to perspective, the picture would appear "flat" and the effect be lost. Shadows are not only highly desirable, but necessary. They must be obtained correctly not only from a viewpoint of direction, but as regards density. If the reflecting devices surrounding the radiators (illuminants) are of relatively small area, and from such area deliver a great flux of light in one general direction, the shadows caused by such volume, other things being equal, will be too intense; whereas, if the radiator is assisted by a somewhat larger secondary radiator (reflecting surface) the shadows will appear less dense. It is impractical to make recommendations as regards characters of radiators without exact knowledge of requirements. It would appear, however, that mercury tubes, properly equipped and placed, possibly supplemented by a general, more or less indirect lighting, would accomplish the purpose; further it would appear to be desirable to move about the mercury radiators, so that changes of directions of shadows would be possible, for while a

shadow from left to right may be correct for certain classes of work, for others the direction of the shadow should be more or less reversed. The radiators being movable, operators would be enabled to literally paint the picture with light to any degree of intensity they deem fit. The writer would be pleased to advise further in this matter if complete details are available.

Albert Jackson Marshall, Manager
Architectural Department, Holophane Company
New York

19—38. Do member companies experience trouble through installation of starting devices (used in connection with alternating-current motors) which require inordinately high starting current?

What regulations are in force by stations governing amount of current permitted in starting devices?

This company has experienced no particular difficulty through the installation of starting devices for alternating-current motors, provided care is exercised in selecting the proper characteristics of motor and starter for each condition.

For driving machine shops and similar work, where no high starting torque is required, squirrel cage motors are recommended because of simplicity. Above five horse-power, auto-starters or compensators are provided to reduce the starting current. As the torque of an induction motor varies roughly as the square of the applied voltage, the use of such a starting device will greatly reduce the starting torque, but in such cases as are mentioned above, this is no particular disadvantage.

Smaller motors are thrown directly on the line, though in some cases we equip these with double-throw switches with heavier fuses on the starting side.

In some cases, such as in crane hoisting and elevator work, where a starting torque equal to several times full load torque is required, we recommend a motor with a phase wound rotor. The ends of the windings are connected to slip rings and thence to a three-phase variable resistance rheostat. At starting, the rheostat is all connected into the circuit and the motor starts at full line voltage, and hence with a powerful starting torque. Then the rheostat is gradually cut out and the motor allowed to come up to speed. The same rheostat may be used for speed regulation, though, of course, such regulation is very uneconomical.

W. H. Lines
Rochester, N. Y.

19—40. What per cent speed variation will a 10 per cent increase or decrease of voltage make on a normally loaded induction motor?

The slip of an induction motor operating at a given load, running on a system of constant frequency, varies inversely as the square of the

voltage. If we assume, for instance, that a motor running, say, at full load, has 4 per cent slip with normal or 100 per cent voltage applied, the same motor at the same load would have 5 per cent slip with 90 per cent voltage and only 3.3 per cent slip with 110 per cent voltage.

Assuming the motor to be wound with six poles for 60 cycles, its synchronous speed would be 1200 revolutions per minute. Its full load speed at voltages of 100, 90, and 110 per cent of normal, would be 1152, 1140 and 1160 revolutions per minute.

It is readily seen that the difference in speed for a change in voltage becomes greater the heavier the load on the motor. At no load, the resulting difference would be so slight as to escape detection in ordinary practise.

H. H. Barnes, Jr.
General Electric Company
New York

The slip on an induction motor varies inversely as the square of the voltage. A 10 per cent increase in voltage will, therefore, cause the slip to be reduced 21 per cent, and a decrease of 10 per cent in the voltage will cause the slip to increase 17 per cent. In other words, a motor having a normal slip of 5 per cent would run about 1 per cent faster on a 10 per cent increase in voltage and .85 per cent slower on a 10 per cent decrease in voltage.

Aldis E. Hibner
Toronto, Canada

On standard commercial motors, running under normal load, a variation of 10 per cent above or below rated voltage should cause less than 1 per cent variation in speed. For slight variations in voltage the corresponding speed variation can be determined from the slip which varies as the quantity $\frac{(\text{Rated Voltage})^2}{(\text{Impressed Voltage})^2}$

To show how this is applied, we will assume a 220-volt motor with a synchronous speed of 1,200 revolutions per minute, and an actual speed of 1,152 revolutions per minute, at normal load (corresponding to 4 per cent slip). Then at 10 per cent increase in voltage we will have $.04 \times \frac{(220)^2}{(242)^2} = 3.3$ per cent slip, which corresponds to an actual motor speed of 1160 revolutions per minute. For 10 per cent decrease in voltage we will have $.04 \times \frac{(220)^2}{(198)^2} = 4.9$ per cent slip, or an actual motor speed of 1160 revolutions per minute. This shows a speed variation of .7 per cent for a 10 per cent increase in voltage, and a speed variation of .95 per cent for a 10 per cent decrease in voltage.

B. S. Gramley
Waukegan, Ill.

An induction motor at no load runs at a speed practically determined by the number of poles and the frequency, and independent of

the voltage. This is called the synchronous speed. When the motor is loaded the speed will decrease by an amount termed the slip. The effect of change of voltage will be to change the slip only. If therefore the full load slip be 5 per cent, we would expect a voltage variation of 10 per cent to make a change of speed about 1-2 per cent.

A. G. Rakestraw
Pittsburgh, Pa.

20—68. What practise have member companies in regard to inactive meters? Are meters promptly removed or permitted to remain on the chance of securing new business, and if so, how long?

In houses and apartments where a successor is likely to move in within ten days, the meter is left in with service ready for the lights to be turned on. We find this has been instrumental in securing the successor's business in a great many cases. The current consumed during the ten days is not charged to the successor, but with very few exceptions the reading of the meter is usually the same as it was on the date of the removal of the former occupant. If, after ten days, the premises are still vacant, the meter is removed and a card placed in a conspicuous position in the apartment, calling attention to the fact that the premises are wired, giving the company's telephone number, with the request that the new occupant call up the company office for an agent to call and secure application.

F. G. Schuettge
North Shore Electric Company
Evanston, Ill.

We believe it to be better practise to remove meters, where customers move or discontinue service. This tends to decrease investment in meters, as it prevents a considerable number of meters lying idle and also because it presents an opportunity for cleaning and overhauling meters, in addition to the regular inspection which they receive.

E. J. Richards
Fitchburg, Mass.

20—70. What is the best method of measuring the simultaneous maximum demand for a customer having eight three-wire direct-current meters? The meters are connected from a sub-station bus, to which other customers are also connected.

If this were an alternating current circuit, it would be possible to meter the maximum demand by linking the secondaries of eight series transformers. For the direct current conditions, there is no indicator known to us which will do this work. The use of eight curve drawing instruments, one on each circuit, would afford a means of estimat-

ing the maximum demand by inspecting the eight records. This method, however, would be cumbersome, and hardly practical.

F. H. Bowman
General Electric Company
West Lynn, Mass.

If possible, we would run a separate bus for the eight meters and install two current transformers and small capacity maximum demand meters.

H. B. Williams
Chicago Heights, Ill.

We are using a printing attachment, applied to standard meters, which prints the dial reading on a paper tape. This device is supplied to us by the Minerallac Company of Chicago. It prints the reading of the dial at from 5-minute to one-hour intervals, as desired. This device can be attached to any of the standard makes of meters that are on the market. By means of this device the maximum demand can be obtained for any interval of time and the record will show the time that this demand occurs.

Buffalo General Electric Company
A. E. Le Fever, Foreman Meter Department
Buffalo, N. Y.

It would seem necessary to group the eight feeders in such a manner that they could feed through a single set of conductors in which two ammeters, one in each outside wire, could be placed. It may be possible to get correct results from using meter resistance shunts in each circuit and connecting all of each side in series with a milli-voltmeter calibrated to indicate in amperes.

M. O. Jenkins
New York

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass. Let them come!

An advertisement used in Brooklyn the day upon which the second of two boiler explosions occurred:

Two Explosions in Four Days in Brooklyn Steam Power Plants

RESULT

1. Loss of life and injury to employees.
2. Financial loss to the firm due to
   (*a*) Employers' liability to employees killed. (Law of Sept. 1, 1910)
   (*b*) Loss of business.
   (*c*) Disorganization of force.
   (*d*) Incapacity of employees through fear of recurrence of accident.

DOES IT PAY?

To take such chances when Edison Electric Power may be obtained just as cheap?

OUR NEW POWER PROPOSITION

Covers the full supply of all light, heat and power at a rate so low as to make the operation of the private plant, with its attendant liabilities, a losing proposition. WE'LL SUPPLY STEAM TOO, IF NECESSARY.

COMPLETE TESTS ON INDEPENDENT PLANTS WILL BE MADE AND RATES GIVEN ON APPLICATION AT ANY OF OUR OFFICES.

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN

884 Broadway **360 Pearl Street** **5114 5th Avenue**

TELEPHONE MAIN 6640 (Connecting All Branches)

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

Some of our more attractive window displays have been as follows:

Thanksgiving week the window was divided by a partition, making a kitchen and dining room. With the aid of wax figures, we had the maid cooking by electricity and the family seated around the dining room table, which was fully equipped with appliances.

The week of the recent aviation meets, we had a small monoplane in our window suspended by fine piano wire from the ends of two of the blades of a ceiling fan. By connecting a 16-candle-power lamp in series with the fan, the speed was just great enough to make the monoplane describe a twelve-foot circle. The monoplane, a reproduction of the Bleriot, was made of dowel-pin wood, cardboard and wire at a cost of $.54 for material and three evenings of labor. We were offered from $10.00 to $25.00 for this display by merchants from other towns.

During a "Merchants Week" last June, we made use of a window display, which not only attracted much attention, but was also effective in making sales.

By calling upon our large power customers we found that they were only too glad to give us a sample of the product they were making on our service. These products, with small cards, such as "COURTESY OF .... CO." were grouped in our window, around a 20 horse-power motor bearing the card "ALL THESE ARTICLES MANUFACTURED BY ELECTRIC POWER ON EDISON SERVICE." In this way we had about everything used in the manufacture of shoes, namely: patterns, dies, tools and knives, lasts, soles, heels, rands, welts, leather-board, dyes and blacking, finished shoes, printing and packing boxes.

By co-operating with the merchants, we have been able to go into their stores and borrow anything that we may need to use in window displays. This has been a great help in the matter of furniture, wax figures, clothing, etc., which we have always found very effective in attracting attention to our windows.

Brockton Edison Company
Brockton, Mass.

We arranged with a local concern in town to lend us a cabinet mantel and we put in the fireplace a luminous radiator. This demonstration we believe has resulted in the sale of at least four or five heaters, though they did not stay in the window more than two nights.

Thomas W. Peters
Columbus, Ga.

We believe the most attractive window display is in the form of a demonstration by placing a gas or an electric appliance in the show window in actual use. The flame coming from a gas burner, or the revolving of a wheel, always attracts attention.

We also allow dealers floor space in our office once a month to demonstrate their electric appliances, such as washing machines, vacuum cleaners, etc. The demonstrations mentioned have been a source of increased consumption on our lines, as the dealers have always been successful in closing numerous sales.

C. F. Schake
Rochester, N. Y.

22—31. What is a fair yearly charge per 16-candle-power lamp for suburban street lighting, the service to be multiple, 118-volt; to include all construction work, lamps, an all-night service, and controlled by a time switch. The company's lines serve the district with residence lighting.

The price for street lighting must vary according to the particular circumstances of each case, although of course there is great similarity in many of the items. For a statement of the items that make up the cost of street lighting, would recommend the report on the cost of street lighting at Atlanta, Georgia, and one made some time ago to the Mayor of Boston. These are both old, but the principles are well stated. These, and undoubtedly other reports, can probably be obtained through the N. E. L. A., and through the same source you can doubtless obtain the prices charged for street lighting in your part of the country. I also suggest that you write directly to plants within a radius of two hundred or three hundred miles, to obtain their prices.

Alex. J. Campbell
New London, Conn.

We believe a fair charge for 16-candle-power lamps for suburban street lighting to be about $18.00 per year for all night every night service. This figure is based on the average price paid for labor and material.

Thomas W. Peters
Columbus, Ohio

22—33. Is there any company having in operation a flat-rate window-lighting agreement? If so, what is it and how does it work out?

We apply our regular flat-rate sign schedule to window lighting. The installations require somewhat closer checking than does sign work, but not enough to be a serious objection to the rate. Customers who would ordinarily turn their lights off at 10:30 if on a meter are readily induced to sign up for our midnight flat-rate schedule, because it appeals to many customers to know in advance exactly what a given service is going to cost.

B. W. Mendenhall
Salt Lake City, Utah

The company has secured considerable flat-rate window lighting business with a concessional wiring price of $1.00 per light, furnishing 60-watt tungsten lamps, equipped with Holophane shades, the lights spaced properly to secure the best results, and a charge for such service is made of 20 cents per lamp per week under a two year contract. The lamps burn from dusk to 10 P. M. six days per week and from dusk to 12 P. M. Saturdays. The company patrols the lights and furnishes all renewals and keeps the installation clean and in good order at all times.

F. G. Schuettge
North Shore Electric Company
Evanston, Ill.

When the writer was with the Auburn Light, Heat and Power Company at Auburn, New York, we had in operation a flat-rate window agreement. We were able to install a number of tungsten lamps at the rate of $1.60 per 100-watt lamp per month including renewals and maintenance. We had 90 per cent. of the lighting of the main streets of the town. With all due respect to the great rate experts. the public like a flate-rate proposition and wherever it is put in force it has been a source of profit to the electric lighting company. In Auburn the lamps burned from dusk until midnight.

Eugene Creed
Toronto, Canada

22—84. In changing from a flat-rate of 12 cents a kilowatt-hour for lighting, to a combination of service charge and kilowatt-hour charge, is it advisable to discontinue the 12-cent rate entirely, after 60 days' notice, thus forcing customers to take the new rate; or allow the 12-cent rate to remain in force for two or three years?

It is not advisable to discontinue the 12-cent rate as suggested. Don't force any considerable body of present users to submit to any unnecessarily rapid changes. Many of them probably will learn, or can be shown, that the new schedule is better for them now, or will be through the increased use of current they can get for the same or little more money. Each one who is so persuaded reduces the weight of the natural opposition to any change. The old fable of the Boy and the Bundle of Sticks is applicable in these cases.

Samuel Scovil
Cleveland, Ohio

There is some information lacking, the most important, perhaps, being that it is not stated whether under any circumstances the new scheme a customer can pay higher than 12 cents per kilowatt-hour, which would have some bearing. If 12 cents is higher than any customer's rate will possibly run under the new schedule, it might be very reassuring to concede that the customers can remain on the old rate if they wish, at the same time advising them to go on the new one. Even in this case, however, I should see that the customer is followed up very promptly after a month's consumption, and shown that he is paying more than he should, and gotten onto the new rate.

Otherwise customers will come back after a year or longer notwithstanding the fact that they had themselves decided to stay on the old rate, and will on finding that they would have been better off on the new rate, feel abused because they were not forced to go onto it, and will want to adjust the matter by obtaining a rebate for the entire time.

If, on the other hand, there is a possibility under the new schedule, in the case of certain customers with very poor load factor,

of paying more than 12 cents per kilowatt-hour, my advice, based on experience, would by all means be to give fair notice of what the company proposes to do, and then on a given date change all the customers to the new schedule.

John F. Gilchrist
Chicago, Ill.

In my opinion it will never be possible to discontinue entirely a maximum kilowatt-hour rate, even after the end of two or three years. If you try to discontinue it at once you will have immense trouble, and just as much if you try to discontinue it three years later.

I do not know of any company of any size that has succeeded in getting along without some maximum rate per kilowatt-hour for all customers using over $1.00 or $2.00 a month.

R. S. Hale
Boston, Mass.

I doubt whether it will ever be possible or desirable to entirely eliminate the flat meter rate. Most people are agreed that it is far from perfect, but its simplicity and long-established custom combine to give it a standing.

Would suggest having the two rates; namely, a flat meter rate and also one combining a service charge and a low charge for current. The latter rate should be so arranged that while the flat meter rate will be the cheaper for customers using a demand up to 700 or 800 hours per year, the second rate will be cheaper for customers burning long hours, such as drug-stores and others entitled to a lower rate. This they will obtain automatically.

I think you will find that the flat meter rate (in your case 12 cents), will be used by most residence customers and many stores.

Alex. J. Campbell
New London, Conn.

I can see no reason why the old rate should not be continued indefinitely, and allow customers to have their choice. If they are educated as to the principle of the fixed charge, a large number will no doubt change over without any trouble. Any attempt to force a change of this kind on the public will be sure to cause considerable dissatisfaction, even if the change be to their benefit.

A. G. Rakestraw
Pittsburg, Pa.

The system of charges of this company has recently undergone a change from a straight kilowatt-hour basis with a sliding scale of discounts, according to consumption, to the demand system of charges.

This matter was thoroughly discussed at open meetings of the local Board of Trade, and was finally passed upon and approved by the United States Circuit Court of the Eastern District of Louisiana.

It was the order of the court, and we have found it good policy, to continue all old contracts until their termination, but all new business and renewals to be run on the new basis.

We will be glad to furnish any member company copies of these rate schedules upon application.

M. S. Hart, Manager for Receiver
Consumers' Electric Company
New Orleans, La.

22—85. What has been the experience of companies with flat-rate lighting contracts for long-hour burners, and residences, by using excess indicators or flat-rate controllers? Is the maintenance of these flat-rate controllers equal to or less than the integrating watt-meter?

We have been installing excess indicators on the flat rate residential and commercial lighting for the past eighteen months and have in use approximately 1800 indicators. We find that the maintenance of these instruments up to date is practically negligible; also that we make a perceptible saving in this system, owing to the fact that it is not necessary to visit each installation each month as is required with the meter system. During the above-mentioned period we have installed in residences 35,000 low voltage tungsten lamps on this flat rate system.

R. W. Rollins, General Manager,
The Hartford Electric Light Company
Hartford, Conn.

22—86. Should the demand charges of a station be apportioned according to the customer's average maximum demand or to the customer's maximum average demand, or to both; also what is a fair method of apportioning these charges among off-peak consumers?

When demand indicators are used the best practise appears to be tending towards the average of three or four highest readings during the year.

In regard to apportioning demand charges among off peak customers, there is no reason for making any concession to off peak customers, unless necessary to get business that could not otherwise be obtained, and in this case it is merely a question of how much concession must be made.

It should be remembered that central stations sell 97 per cent of their kilowatt hours off the peak, so that if it is just to make any concession to a customer whose demand comes off the peak, there are a good many kilowatt hours to be affected by such a concession.

R. S. Hale
Boston, Mass.

22—87. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given?

Are there any member companies giving off-peak rates or lower rates for cooking?

The company with which the writer is connected gives "Off-Peak" rates on sign lighting and outlining. The lights and signs are controlled by patrolmen and time clocks.

Eugene Creed
Toronto, Canada.

We give an off-peak rate for power where the customer, instead of guaranteeing to use or pay for current to the amount of $1.00 per horse-power per month, guarantees to use or pay for current to the amount of $12.00 per horse-power per year. Bills for current consumption are rendered monthly as under other contracts.

Thomas W. Peters
Columbus, Ga.

We have a peak between 4.00 p. m. and 6.00 p. m. during winter months. For installations up to 100 horse-power the off-peak business is controlled by occasional inspections. On larger installations, Bristol meters or curve drawing instruments are used. On many installations of 500 horse-power or over, special circuits are constructed. For night service—6.00 p. m. to 7.00 a. m.—about half of day rate is given, in which case two sets of meters are used with double throw switch in the shunt circuit of meter and recording volt meter. Off-peak rate is given to any class of power service in small installations; and in large installations where primary current is measured and where consumers furnish their own transformers, light and power both may be used. In the latter case where additional 110-volt lighting service is required during peak hours, it is furnished at regular lighting rates, based on consumption.

H. C. Alvord
Montreal

22—38. Concerning specifications for street lighting:

(a) Is it advisable to base a contract for arc lighting on a rate per lamp per year of a fixed number of burning hours, or to base it on the energy consumed?

(b) In the lamp specifications, what factors should be included in order to avoid ambiguity?

(c) What is considered the most definite unit of illumination?

As between the two items mentioned the charge per lamp per year for a fixed number of burning hours would be better than a charge apportioned to the energy.

A better method still is to charge per lamp per year at a fixed charge irrespective of the number of hours, plus a small charge per hour. As for example: a fixed charge of $42 a year, irrespective of the burning, plus a charge of 1½ cents per hour for each hour burned,

so that 4,000-hour burning would be \$42 + 4,000 × 1½ cents, making \$102 per year.

(b) The best way to avoid ambiguity in lamp specifications is to submit sample lamps and carbons which the street authorities can keep in their safe or some place where they cannot be tampered with. Then the company merely guarantees to give as good service as could be given by these sample lamps and carbons.

R. S. Hale
Boston, Mass.

Various specifications have been printed and recommendations made in the publications of the National Electric Light Association and the Illuminating Engineering Society. In the N. E. L. A. Bulletin of January, 1908, will be found a form of agreement for municipal street lighting which is suitable for general use.

Answering your specific questions:

(a) It seems to me better to fix the rate per lamp per year for a fixed number of burned hours rather than on the energy consumed. In street lighting you are distinctly selling a service and not energy. The cost of rendering this service includes many fixed items of expense which do not vary in proportion to the energy consumed, hence the difficulty of basing the price on the current consumed. For example, in incandescent street lighting, in changing over from the carbon lamps say of 25 candle power to tungsten lamps of say 40 candle power, and assuming that the rate per lamp per year remains about the same, as it should for reasons that need not be discussed here, it will be found that the price received per kilowatt hour goes up very materially, and if you were selling street lighting in this case per kilowatt hour, your rates would fall off materially when you changed to tungsten lamps, whereas they should at least remain the same if they do not increase. Street lighting is, very distinctly, a service and not a commodity.

(b) One method that we have used and that seems simple is to agree with the municipality on the particular lamp that should be used and then to describe that lamp. You can even, if desirable, include the make and catalogue number. It is often well to include the word "commercial," because commercial accuracy is different from technical accuracy. For example, you might specify that "the lamp shall be what is known commercially as the 6.6 amperes, series enclosed arc, and shall be equipped with clear globes and metal reflectors painted white;" or, "the lamp shall be what is known commercially as the 40 candle-power series incandescent lamp." In the latter case you can also state the amperage if it seems advisable. In the case of incandescent lamps, it seems best not to specify the amperes or the wattage, because a change in efficiency might enable you to furnish the same

candle power with a smaller current consumption or a greater candle power with an equal current consumption.

Alex. J. Campbell
New London, Conn.

22—29. What is the best schedule of rating for "abnormal" incandescent service, by which I mean large commercial contracts or contracts outside of the ordinary. Our standard rates for incandescent service here are eight and nine cents net for domestic and commercial service respectively, and as regards perhaps 90 per cent of our business, the rates are popular and acceptable, but it is the other 10 per cent that are deserving of better treatment that I am worrying about, and I would like to know as stated, what is the best way to grade the rate for quantity consumption on these contracts?

The best plan for handling wholesale customers is, I believe, to charge a fixed sum per kilowatt of monthly demand as a primary charge, and a secondary charge per kilowatt hour exclusive of lamps. What this primary and secondary charge will amount to will depend upon the investment of the station in question and its cost per kilowatt hour.

John F. Gilchrist
Chicago, Ill.

What we would all like is one schedule, based on cost, which will automatically give the proper rate for any given installation of a given load factor. Several schedules are in use in various cities which approach such a universal schedule, but isolated cases often occur to which the schedules will not apply. These prospects are then either given up for the time being or the central station makes a rate based on the cost factors entering into the individual case.

The question is very general in character and admits of a general answer only.

Mathias Turner
Cleveland, Ohio

The writer believes that one or more schedules can be made up which will take care of all business that may come to the company and that will automatically give low rates to those that deserve them. A combination of service charge plus a low rate for current, properly arranged and graded, does this very nicely, and in conjunction with the flat meter rate meets substantially all requirements. This also does away with special rates, as the rates in question are open to all and any customer is entitled to choose the one that is best for his case. The best concrete example of rates of this kind known to the writer are those in use by the Edison Electric Illuminating Company of Boston. We have adopted very similar and almost identical rates, under widely dissimilar conditions, with very satisfactory results.

Alex. J. Campbell
New London, Conn.

We would hesitate to make a rate lower than 8 cents per kilowatt-hour for commercial service, especially when 90 per cent of the customers are satisfied. We believe the rate question to be a serious one. We feel that the time is but a short way off when the small consumer will receive the same rate as the large consumer.

E. P. Gosling, Superintendent
Old Colony Street Railway Company
Newport, R. I.

The fixed charge plus a low meter rate is the most accurate from a scientific standpoint, but as this does not meet with favor everywhere, there are several ways of accomplishing the same ends with more or less accuracy. One is to vary the meter rate according to the amount of business guaranteed, for instance, 8 cents rate for a $5.00 minimum per month, 7 cents for $10.00, etc. Another, and which I consider a better way, is to make successively lower rates for longer use of the maximum demand, known as the Wright demand system. This is in successful use in many places.

A. G. Rakestraw
Pittsburg, Pa.

24—30. Is it policy for a central station to sell heating and cooking appliances at cost or less, or should such appliances be sold at such a profit as to make price not less than the price of same articles sold by contractors, supply houses and department stores?

It depends largely on the character of the community you are serving. If maintaining list does not keep down sales there is no reason for cutting prices. However, profit from the increased sale of current is the main object in pushing heating appliances. In the case of flatirons you can afford to sell them for cost if increased sales result.

Laurent Heaton
Middletown, N. Y.

If central stations sell heating and cooking appliances at cost or less, this naturally discourages the sale of the same appliances at the hands of the contractors, supply houses, and department stores. On the other hand, if the central stations make their prices correspond with the selling prices of the dealers in electric goods (in case their prices are generally reasonable) it promotes the sale of the appliances, thereby increasing the load. In case the prices of the contractors, supply houses, etc., are exorbitant, the station would set a reasonable standard charge.

William G. Merrick
Providence, R. I.

Depends very much on local conditions, especially in small cities, towns or villages. In large cities where there has been much advertising of heating and cooking appliances and perhaps low prices,

during the past several years and many appliances are in use, many central stations have found it advantageous to now maintain proper sales prices. Under these conditions probably as many or nearly as many appliances are sold, as would be sold at cut prices.

Mathias Turner
Cleveland, Ohio

By selling heating and cooking appliances at about cost to its customers, the central station will be able to get most of this business, and will thus keep in closer touch with the customers' connected load; a matter of considerable importance in determining transformer and meter capacities. Also if the apparatus is purchased from the central station, the customer will notify the central station of any trouble with it. The central station naturally will give more attention to such complaints than would a department store or supply house, therefore, the apparatus will give greater satisfaction.

William Rawson Collier
Atlanta, Ga.

The profit from the sale of an electrical device is quite a small matter compared to the revenue derived from its use. From this point of view it would be an advantage to sell at cost. To do so, however, would be to incur the resentment of the electrical contractors, which would be poor policy. On the other hand, the central station has advantages in the matter of introducing electrical devices possessed by no one else, and we cannot, therefore, leave the sale of the articles entirely to the contractors. I should think the best plan would be to advertise and display the devices in every possible way, and push the sale with all our might, but not to cut the price, at least only slightly.

A. G. Rakestraw
Wilkinsburg, Pa.

We do not consider it good policy for a central station to sell heating and cooking appliances at cost or less, as we believe that contractors and stores should be able to handle the same class of goods, particularly as few who can afford to use these appliances cannot afford to pay the profit on same.

W. R. Putnam
Marinette, Wis.

Heating appliances are, as a rule, pushed by only the central station. Therefore a charge of cost plus a certain proportion to cover handling is a fair charge to the customer.

J. M. Field
Poughkeepsie, N. Y.

We believe it is decidedly good policy for a central station to sell heating and cooking appliances near cost, inasmuch as the average consumer is liable to regard such appliances more or less as luxuries; hence it is necessary to keep the first cost as low as possible.

We have tried both ways, and find results to be very much better under a system of selling at cost. **F. H. Golding**

Rockford, Ill.

This company believes that good policy requires the sale of heating and cooking appliances at a reasonable price to the customer. A reasonable price includes a reasonable profit. If an appliance is efficient, and only those that are should be sold, a reasonable profit will not prevent its sale and the purchase price paid by the customer is a guarantee of its continued use. If contractors, supply houses and department stores are selling these goods at a reasonable profit the central station should not undersell them.

The practice of this company is to sell heating and cooking appliances at a profit.

Public Service Electric Company

P. S. Young, Comptroller

Newark, N. J.

We find it quite an advantage in placing appliances on our system to sell them 10 per cent above the actual cost to us, which just about covers the expense of handling but still brings the prices below that maintained by contractors.

W. M. Lewis, Manager

The Rockville Gas & Electric Co., Rockville, Conn.

We sell electric heating and cooking appliances at the regular merchandizing price the same as department and other stores. We believe such apparatus should be sold at a profit. We have never found that the selling of them at absolute cost was of any great benefit to us. **E. W. Lloyd**

Chicago, Ill.

This is a question of expediency. In most cases it will be found that in order to push effectively the sales of appliances, dependence cannot be had upon local selling agencies, other than the central station. In view of the fact that sales of appliances contribute to the convenience of the service and to the sale of current, such appliances should be sold at cost, meaning actual cost plus a sufficient margin of profit to offset the expense of handling the business.

Douglass Burnett

Baltimore, Md.

In the writer's judgment, it is poor policy for a central station to sell heating or cooking appliances at cost, or less. The company with which the writer is connected, sell these appliances at the market price, getting $6.00 for an electric iron; $4.50 for a toaster, and prices for other appliances in proportion. Many supply houses and department stores sell appliances for lower prices than we ask, yet we have no trouble in selling current consuming devices to our customers.

E. Creed

Toronto, Canada.

It is the policy of many central stations to sell heating and cooking appliances at such a price as will net a good profit. It is our experience that supply houses and contractors try to maintain the same schedule of prices as maintained by our company. One or two supply houses sell irons and heating appliances a trifle below the price set by our company but the appliances handled by these contractors are not those handled by this company. We try to handle the appliance that is the most economical and efficient manufactured.

R. B. Mateer
Denver, Colo.

We find it a good policy in this locality to sell heating and cooking appliances at cost plus freight and handling.

Thomas W. Peters
Columbus, Ga.

24—88. (a) Is there any member company that does not bond its collectors?

(b) On what basis do member companies bond their collectors, i. e., a uniform bond for all collectors, or does bond vary in accordance with conditions of collector's territory?

(c) Do member companies pay for bonding collectors, or are collectors required to pay their own bond premiums?

(d) Do member companies in which collectors are bonded turn the cases over to bond company to settle in case of collector defaulting, or do they settle cases themselves, notwithstanding the fact that collectors are bonded?

(e) Do any member companies have their own bonding fund?

(f) What do member companies that do not have collectors bonded do if collectors should default?

(g) In last ten years how many collectors have defaulted?

This company does not employ any collectors. It uses the discount rule, allowing 10 per cent discount if paid on or before the 10th day of the month; therefore, we have no use for collectors. Our accounts are either guaranteed or covered by surety deposit.

E. J. Bowers, General Accountant
Kansas City Electric Light Company
Kansas City, Mo.

(a) The Commonwealth Edison Company bonds all of its collectors.

(b) All contractors are bonded either for $1,000 or $1,500, according to the importance of the territory in which they collect.

(c) The company pays for all bonds.

(d) This company has never had any case serious enough to be turned over to the bonding company.

William A. Fox, Treasurer,
Chicago, Ill.

(a) The New York Edison Company requires collectors to furnish surety bonds.

(b) All collectors are bonded in the same amount, viz.:—$5,000 each.

(c) The company pays the premiums on bonds.

(d) It is customary to notify the surety company, if an intentional irregularity is discovered in a collector's work; it is almost always possible to determine very quickly, under our system, whether the irregularity is systematic and intentional, or the result of error or inaccuracy. Should it be apparent that a collector has "juggled" his returns, his work as a collector stops at once, as a matter of course, and the surety company usually, after getting the facts, handles the matter in its own way.

It has been necessary, however, in the last ten years to make but two claims on the surety company, and these in but small amounts, considering the amounts of collections handled.

(e) No.

(f) No experience.

(g) Five have been short—two of the foregoing shortages were paid by the surety company, and the other three shortages were made up by the employees.

H. M. Edwards, Auditor New York Edison Co.
Per John C. Van Duyne

(a) The Philadelphia Electric Company bonds all collectors.

(b) $1,000 on each collector.

(c) This company pays the premiums as it is for their own welfare to bond.

(d) If money can be obtained from collector, this company settles with him, if not, they turn it over to the bonding company.

(g) Have no figures but it is a rare occurrence.

J. A. Coe
Philadelphia, Pa.

24—36. What is the best policy for central stations as regards the renewing of tungsten lamps, also at what price should they be sold? By this we mean, whether they are to be sold at list prices, net prices, or should they be replaced free when burned out. This should apply to stations of our size. Our city has a population of about 28,000 with a station capacity of 1500 kilowatts. Our present practise is to have all meter customers purchase their first installation of carbon lamps at $2.50 per dozen. After that, we renew the carbon filament lamps free when they are returned burned out, to our office. Tantalum lamps and Gem lamps we renew for 25 cents less than the list prices. Tungsten lamps we do not renew at all, but sell them at list prices. Also would it be better to raise our rates one or two cents per kilowatt-hour and then furnish free tungsten lamp renewals. Our rates for residence lighting average from 12 cents to 7½ cents net.

We sell tungsten and tantalum lamps at a fraction above cost price, enough to cover breakage due to handling and shipping. I do not believe that tungsten or tantalum lamps should be replaced free. We furnish all carbon and Gem lamps, first installation and renewals, free. Our lighting rates average 12 cents net.

E. P. Gosling, Superintendent
Old Colony Street Railway Company
Newport, R. I.

We believe that a satisfactory maintenance charge can be figured out for each company. This charge should include washing the glassware and renewing lamps. We have a maintenance charge for tungsten lamps which is based on approximately 190 hours average use per month, with a life of about 1000 hours. Before the customer is placed on this maintenance charge, his lamps must be placed on approved fixtures such as the company may prescribe. We believe that tungsten lamps should be sold at list price, otherwise, the customer would get all the benefit in the saving of current due to the high efficiency in the lamps.

Thomas W. Peters
Columbus, Ga.

We sell tungsten lamps at list. If these lamps were not so valuable and liable to be stolen, and also so fragile and apt to be broken by carlessness, they could be furnished free, but it would be necessary to add at least three cents per kilowatt-hour to cover the cost of lamps. As it is, I think it is far better to allow the customer to purchase them.

A. G. Rakestraw
Pittsburgh, Pa.

We believe that all customers should pay list prices for tungsten lamps; with the present tungsten filaments, free renewals are not advisable; with the present prices of tungsten lamps, free renewals on the basis of 600 hours lamp life will cost from 3¼ cents to 1½ cents per kilowatt hour—according to the size of lamps renewed and at 100 hours from 1 9/10 cents to 8/10 cents per kilowatt hour. Rates could be adjusted to suit these prices if it were not for the uncertainty as to the life of the lamps; due to careless handling by the customers.

W. R. Putnam
Marinette, Wis.

24—28. Would it pay a company with a night load only, and a revenue of less than $900 a month, to install duplicate machinery to guard against shut-downs?

Presumably this company has about a 100-kilowatt unit. By installing a 50 kilowatt unit, to be run during the light load period, a saving in coal would be effected which would exceed the fixed

charges on the additional equipment, and at the same time, this equipment would provide a means of carrying all but a small peak of the load, in case of a breakdown in the larger unit; also a day load could probably be quickly developed, which would pay for an additional man and the quarter to half a ton of coal required for the day's run, with a smaller engine.

C. A. Graves
Brooklyn, N. Y.

In the writer's opinion, it would not pay the company indicated to install duplicate machinery to guard against shut-downs on a small plant with a night load only, as with proper management, there ought to be sufficient time during the daily period of shut-down to keep a plant of this character in good condition for nightly operation.

E. J. Richards
Fitchburg, Mass.

24—40. This company is operating three plants, furnishing water, gas and electricity. We have a new-business department, whose activities cover both the gas and electric departments, and whose head is not under either the gas or electric superintendent. Neither are the gas or electric workmen, who do wiring, gas-fitting, etc., under the new-business department. This introduces questions of jurisdiction and responsibility which are difficult of solution, and I should be glad if you will publish an inquiry as to the organization in use by different companies operating two or more distinct utilities in the same city—this not only as regards the new-business department, but covering the entire organization. References to any matter which has appeared in either books or periodicals, dealing with the operating organization of combined utilities, will be appreciated.

The electric division of this company has a commercial department, as has also the gas division. From each of these commercial departments orders to do work on customer's premises are issued to the respective operating departments. Under this method, such questions of jurisdiction and responsibility troubles, as you speak of, cannot arise.

Douglass Burnett, Manager
Consolidated Gas, Electric Light and Power Company
Baltimore, Md.

From the inquiry, it would appear that this company has two distinct departments—gas and electricity. In a case of this sort we believe the proper form of organization is to have one manager generally responsible for both departments. The manager of the new-business department should be responsible directly to this manager. In such a case the head of the sales department would be directly responsible to the manager and the heads of the jobbing departments should also be responsible to him.

In case there is no general manager who has charge over both branches of the business, then the head of the sales department should be responsible to the superintendent of the electric department on the electric side and to the superintendent of the gas department on the gas side. In this case the head of the gas jobbing department would also be responsible to the gas superintendent and the head of the electric jobbing department to the electric superintendent. Each superintendent would then be called upon to see that proper relations are maintained between the sales department and the jobbing men of his department and that the work done by the jobbing men be accomplished satisfactorily to the sales department, bearing in mind that the results of the new-business department will depend in a measure on the work of the jobbing department in attending to the sales made and the orders for installations received.

Stone & Webster Management Association
Frederick P. Royce, Vice-President
Boston, Mass.

This company is furnishing both gas and electric service in the City of Rochester and adjacent towns under a very similar organization to that outlined in this question, that is, we have a new-business department operating under our commercial agent, he having charge of all of our solicitors, the lamp counter, show room and information desk. Our gas works are in charge of a superintendent of gas manufacture. Our gas distribution system is in charge of a superintendent of distribution under whose direction all of our gas fitters and complaint men come. The electric department is in charge of a superintendent, and all the work of services, distribution, complaints and generation, come under his department. All four of these superintendents report direct to the general manager.

What I wish particularly to bring out is that none of these four men come in any way under the authority of each other. They do, each and every one, co-operate with the other to the end of the highest efficiency and the greatest satisfaction of the company's various customers, both gas and electric, they believing that the success of each individual depends absolutely upon the success of the company as a whole, and while each man is directly responsible for his own work, he feels a keen and appreciative interest in the success of the other, each knowing that they cannot succeed except with the co-operation of all. The management of the company appreciates this so keenly that the least jealousy or lack of co-operation is given immediate attention, and I wish to say, in justice to the heads of the various departments, that it is seldom, if ever, necessary for the management to interfere in any way. Each man knows the absolute attitude of the management. This system tends to the best of good fellowship between the heads of departments, and to co-operation in both deed and spirit to the fullest extent. Success-

ful corporation work can only be accomplished through absolute co-operation from the office boy up to the president of the company, and that is what our president insists upon.

Rochester Railway and Light Company
James T. Hutchings, General Manager
Rochester, N. Y.

The first part of this query involves questions which would depend largely upon the ability and personnel of the individual superintendents and new-business manager mentioned. If the company described has no general superintendent, it would seem reasonable that the manager of the new-business department would report to the general manager of the company.

If the new-business manager were competent to act as a superintendent of distribution there are some apparent advantages in his handling the installation of consumers' equipment.

The latter part of the query is treated in a paper before the National Commercial Gas Association which is published in the Proceedings of that Association, January, 1908, pages 126-7-8 and 9.

George Williams
Henry L. Doherty Company
New York

While perhaps it is easy to lay out an organization on paper, in practise the arrangement must often be modified by the peculiar circumstances of each case, that is, by the way the business has gradually developed and is actually run at the time being, and also often by the individual capacities of the heads of departments.

It will often be found that by tacit agreement of all concerned, one man will be doing more than he is supposed to, usurping to a certain extent the functions and duties of other men who are not so competent or active.

The weak point in the organization outlined in the question is that there seems to be no head. To have one is, I believe, absolutely essential. It might be brought about in one of two ways. First: the three departments or plants, namely: water, gas and electricity, can be operated by one head, each having a separate superintendent in charge, and the head of the new-business department might make a fourth man or department. In this case, the manager of the three plants must be in a position to insist upon and compel harmony and co-operation between the four departments. It would then be the duty of the new-business department to secure new customers or orders, which would then be executed by the forces under the superintendents. In such a case, as already stated, the general manager must promptly and effectively put a stop to any lack of harmony.

A second method, if there is no general manager, would be to have the new-business department work for both the gas and electric departments, and, while working for either one, be absolutely under the

charge of the superintendent of that department. For example, certain men in the new-business department might work in the gas department and others in the electric, or all of the new-business men might work one day for the gas interest and the next for the electric, or some other arrangement may suggest itself.

The essential point is that someone shall have final authority; either the superintendents in their respective departments, or a general manager over all.

Alex. J. Campbell
New London, Conn.

This question should be decided by local conditions entirely, because, in some places it would be policy to have all departments combined, while in other places it would be policy for only one or two of the departments to be combined, and in still other places the policy would require two separate and distinct organizations. In Columbus, Georgia, the gas and electric companies are under the same general management, but each department is separate and distinct, except the accounting department. This arrangement has proven satisfactory so far.

Thomas W. Peters
Columbus, Ga.

25—8. If an electric light company supplies current to a defective installation and a fire results, is the company in any way responsible? Will the installation of safe but unapproved wiring in a building vitiate any insurance that may be in force or increase the premium?

[As a matter of actual practise in New York State, while most insurance policies are stamped or pasted with clauses vitiating the insurance in case there has been unapproved wiring on the premises burned, the impression prevails that insurance companies have not generally attempted, so far as appears, to enforce these clauses, but have usually paid losses, in such cases, without raising the issue.]

The clauses referred to are worded as follows:

"NEW YORK STANDARD CLAUSE FORBIDDING THE USE OF ELECTRICITY. This entire policy shall be void if electricity is used for light, heat or power in the above-described premises, unless written permission is given by this company hereon."

"PERMIT FOR USE OF ELECTRICITY. Privileged to use electricity in the above-mentioned premises for light, and/or heat, and/or power, it being hereby made a condition of this policy that where the equipment is owned or controlled in whole or in part by the assured a certificate shall be obtained from the New York or National Board of Fire Underwriters, and that no alterations shall be made in that portion of the equipment owned or controlled by the assured after certificate is issued without notice thereof being given to the said Board."

Question 25-8, in its two parts, calls for reply from legal and insurance, rather than central station, sources. It was therefore submitted by your editor both to learned counsel and to the fire underwriters' organizations, and the replies received seem of sufficient interest and value to be published in full.—Editor.]

The question resolves itself into two distinct inquiries.

First: "If an electric light company supplies current to a defective installation and a fire results, is the company in any way responsible?"

The service supplying company should be supposed to thoroughly understand the fire hazard involved in the use of electric current, and are in duty bound to use all reasonable precautions to see that the equipment to which they supply current is in safe condition. If due to any negligence on their part or failure to acquaint themselves with the facts a loss should result because of the defective character of the installation, it would undoubtedly make them liable for the amount to all parties in interest, owners, occupants, insurance companies, etc. It is a well-established principle, that responsibility follows fault and/or negligence.

Second: "Will the installation of safe but unapproved wiring in a building vitiate any insurance that may be in force, or increase the premium?"

It is somewhat difficult to arrive at the definite thought in the mind of the writer of the question, but assuming that by "unapproved wiring" is meant wiring which has been condemned by some authority having jurisdiction, it would be fair to suppose that it was condemned because it did not comply with the requirements either of the National Electrical Code, or as they might be interpreted by the authorities referred to. The National Electrical Code is supposed to represent the consensus of opinion of many different organizations as to safe methods to be employed in the installation of electric wiring and apparatus, and these rules if not followed with general regard to all of the requirements would ordinarily indicate that the equipment was unsafe.

As to the vitiation of the insurance, would say, that any change which introduces an additional fire hazard after a policy is in force, is liable to void the insurance. In this connection we refer you to one of the conditions of the standard form of fire insurance policy, wherein it is stipulated that,

"This entire policy unless otherwise provided by agreement indorsed hereon or added hereto, shall be void, etc., etc.," "if the hazard be increased by any means within the control of the insured."

Concerning your inquiry with regard to the possibility of an increase in rate for a defective electric equipment, I cannot make an authoritative reply on this subject, for the reason that this office has nothing to do with the matter of rates. From the standpoint of

equity, however, it would seem inevitable that a defective electric equipment, which admittedly causes an increase in the fire hazard, should occasion a proportionate increase in the rate of the insurance premium. An insurance company will sometimes decline to insure property with defective wiring, even at an increased rate of premium.

J. C. Forsyth, Chief Inspector
Electrical Department
The New York Board of Fire Underwriters
New York.

Your question contains two separate and distinct inquiries.

First: "If an electric light company supplies current to a defective installation and a fire results, is the company in any way responsible?"

We regret that we cannot answer this question, nor do we assume that an authoritative answer could be obtained unless a clear case of this kind has been adjudicated in one of the courts of last resort in this state; and then only for this state. In other words, it is a legal question and not one that we are capable of answering through any of the data on file in this office.

Second: Your question reads as follows: "Will the installation of safe but unapproved wiring in a building vitiate any insurance that may be in force or increase the premium?" We regret that we cannot answer this question, and would respectfully refer you to the insurance company insuring the premises in any particular instance.

G. E. Bruen, Engineer and Superintendent
Electrical Department
The National Board of Fire Underwriters
New York.

As to whether an electric light company supplying current to a defective installation would be responsible if a fire resulted, I would say that if the customer had entire control of the installation in question and the company had no control of the same and no knowledge of its defective character, it would not in my opinion be liable. In other words, an electric company is not liable for damages caused by another's negligence.

There is a case, however, decided by the Supreme Court of Minnesota, where an electric company introduced a dangerous current of high voltage into an interior installation by reason of the primary and secondary wires becoming crossed in the street. There was a defective electric socket within the premises, through which the current passed into the body of a person touching the same, resulting in his death. For this accident the company was held responsible, on the ground that parties installing electric light fixtures in houses are not bound to anticipate that electric light companies furnishing electricity to the public will be negligent in either the construction or maintenance of their respective systems connecting therewith. On the

other hand, I believe that in cases where the fire or accident is due primarily to the defective condition of the interior installation and not to any negligence or want of care on the part of the supplying company, the company would not be held liable.

With regard to the question as to whether the installation of safe but unapproved wiring in a building would vitiate any insurance in force or increase the premium, I would say that this would depend upon the wording of the policy in force in any particular case. If there is no provision in the policy requiring that the wiring be approved by the proper authorities, as a condition to permitting the use of electricity within the premises, it is my opinion that the failure to have the wiring approved would in no way affect the liability of the insurance company. But if the policy does contain a clause, similar to the one used in this state, requiring that the assured obtain a certificate from the board of fire underwriters, as a condition precedent to the use of electricity, and a further clause that no alteration be made in any portion of the equipment controlled by the assured, if such certificate has been issued, without notice thereof to the board, and if in violation of those provisions the assured did either install electric wiring or alter his installation, and a fire occurred thereafter, it is quite likely that the insurance company would escape liability, at least if there were any facts in the case from which it could be legitimately inferred that the fire was what is commonly known as an electric fire.

As to whether or not the premium would be increased in the event of unimproved but safe wiring being used, I would say, that is a question which can best be answered by an insurance company, although I believe that if they require the written approval of the wiring as a condition to permitting the use of electricity, they would adhere srictly to that rule and not deviate therefrom simply in consideration of a slightly increased premium being paid.

Charles I. Taylor, of
Beardsley & Hemmens
Attorneys and Counsellors at Law
(Counsel to N. Y. Edison Co.)
New York

We do not do any inside wiring on a customer's premises except the connection of the meter itself to the meter loop, which is provided by the customer. The customer is required to do all wiring up to a point where the wires run from the house itself to the pole. We do not cut in any installations until after we have had the approval of the local board of fire underwriters. By this method we feel that we are absolutely free from blame in the event of a fire, unless it can be proven that the fire originated in the meter itself.

Buffalo General Electric Company
A. E. Le Fever, Foreman Meter Department
Buffalo, N. Y.

Any electric light company that connects to a building which is not approved by the insurance authorities, is to say the least, taking a share of the risk in case of fire. If, however, the installation is approved by the underwriters' representative, the light company is freed from all responsibility in the matter. Wiring should not be changed in any way, or extended without being re-approved, as this is sure to cause trouble in case of fire.

A. G. Rakestraw
Pittsburgh, Pa.

NEW QUESTIONS

0—31. Can any member give the installation cost and the approximate operating expenses for a year of a private acetylene gas lighting plant for a country home requiring, say, 25 lights? How does the cost of installing and operating an electric lighting plant compare with that of an acetylene plant giving equal service?

1—9. How may the discoloration of brick walls (presumably due to mortar) be prevented or removed?

2—3. What should be the size and spacing of the rack bars for a trash rack in a water power plant? At what angle of inclination should the bars be placed, and what is the loss of head in the rack for different velocities?

3—6. What member companies have installed rotary condensers on their feeders for the purpose of correcting the power-factor? What economies have been shown thereby, also what detrimental results have been demonstrated, if any? Have the advantages offset the cost of making such installations?

4—3. Will any member having reliable data regarding thermal efficiency of house heating devices, hot air, or steam generators, please send such data to the Question Box?

5—7. What are the relative advantages and disadvantages of hand firing and automatic stoker firing of boilers?

6—1. Would it be advisable to use a 4-valve engine over a simple valve of the same type engine, for a 300-horse-power direct-connected unit with 1½-inch net-and-slack coal at 75 cents per ton delivered in your bin?

6—2. What is the saving in fuel of the 4-valve over the simple valve engine and how does it compare in the way of cost of maintenance?

10—38. The efficiency of an 185-kilowatt, 6600-volt, 60-cycle generator was figured to be 93 per cent at full load by measuring the separate losses. It was reported that if the load losses had been included

in accordance with the A. I. E. E. rules, the efficiency should have appeared to be 92 per cent.

What rules do the A. I. E. E. give for computing the efficiency of an alternator?

11—18. Have member companies experienced any difficulty with moving-picture theatres unbalancing line voltage due to moving-picture arc being on one side of system? On alternating-current circuits are 220-volt economizers used? What are the local Board of Fire Underwriters' rulings in reference to 220-volt economizers?

12—38. What effect has the installation of lightning arresters had on the reduction of burnouts and open circuits on both commutator and induction meters? How often is it found necessary to test lightning arresters?

12—39. What method of testing for open circuit is found to be most convenient on arc circuits where tungsten lamps are also used?

12—40. How long does standard weatherproof insulation on No. 6 wire, installed on a pole line, with ordinary weather conditions, continue to be safe insulation for 2300-volt alternating current?

13—13. Is it practicable to operate distributing systems with manhole transformers where manholes are frequently flooded?

14—5. Kindly give values of the resistance of an exide battery from beginning to end of charge.

14—6. In some companies the storage batteries are charged during the period of light load and discharged at the time of peak load in order to increase output of station at that time, while in other cases the batteries are kept floating on the system and discharged only in case of trouble. What are the advantages and disadvantages of each system?

16—35. What success, if any, have member companies had with 250-watt tungsten lamps?

16—36. How is the efficiency of an incandescent lamp determined?

17—29. What means do member companies use to insure installation of the proper size incandescent lamps in residences; do companies when connecting meter use their own discretion as to the proper size lamps to install in cellar, hallways, etc., or is this information secured beforehand from customers, and if so, through what method?

19—42. Do any member companies specify in their motor rules that all alternating-current motors should be of the wound-rotor type to avoid excessive starting current?

19—43. To what extent have single-phase motors been successful on elevator service?

19—44. Will member companies kindly give information relative to aligning shafting for their customers, that is, whether or not they test shafting and report to the customer the condition of the same, or do any other work on shafting?

21—19. What companies send out circular letters to prospective customers? Are these letters prepared by the local advertising manager, or are special advertising agencies employed?

21—20. How many solicitors should be employed to work a city of 350,000 population, where gas competition is very keen and municipal ownership threatened?

21—21. A new-business department would appreciate description, including blank forms, cards, advertising material, etc., of successful systems used by various member companies in their power department. (Replies received will be forwarded to the questioner.)

21—22. What companies offer special wiring inducements for outline lighting of buildings? Do consumers furnish lamps and renewals? Does company furnish man and ladders for renewing lamps?

22—40. What member companies, if any, give a special rate for primary motors (2200 volts), or in what way do they modify their contract for secondary motors (220 volts) in order to take care of this class of service?

22—41. I have recently built an electric oven with heavily insulated walls to take advantage of the fireless-cooker principle, and fitted it with an automatic temperature-controlling device which seems to stand up and be sufficiently simple to be handled by the average person of the sort into whose hands such an oven would fall in domestic use.

So far as tests now being made indicate, the economy of operation is going to compare very well with that of a gas oven, with the advantage of having the automatic control, this with electricity at even 10 cents per kilowatt-hour.

Can you supply information as to the rates made for current for uses of this kind by the various electric companies? Are special rates made for current thus used? If not, what would be the rates charged in small and large cities?

23—21. Wanted: Information or recent data relative to the cost on which electric companies base their minimum charges. That is, figures giving general information as to the stand-by or investment cost per kilowatt along the lines of, say, one hundred dollars per kilowatt for station equipment, and then certain figures for overhead line construction, and certain other figures for underground construction per kilowatt capacity, etc.

23—22. What is the best method of keeping customers' accounts, by cards or loose-leaf ledger, and why?

24—41. Wanted: Data regarding the results of ice-making as a side line by electric light and power companies in the United States? It has been advocated as a good means of utilising power during the hours of daylight, and this is very important to companies using water power.

24—42. What is considered a reasonable amount of money for a central station to spend on soliciting and developing new business, based upon the gross earnings of the company?

I have seen the statement made that some companies spend as high as five per cent of their annual gross earnings for this purpose. Of course, each company would require to treat this matter in the light of their own needs and conditions, but in a general way, what is the largest percentage that companies spend for this purpose, and what is the average percentage spent by the principal progressive American central stations?

24—43. Where company regularly inspects signs and outline lighting what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat rate outline and sign work where competitive electric lighting companies are in same field?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

REPEATED QUESTIONS

The following recent questions have received no reply or inadequate reply. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

4—2. We are buying a good grade of soft coal for $3.15 a ton in our bunker. Can a saving be made by buying pea coal at $2.50 a ton; and approximately what per cent of saving, leaving out the cost of changing grates; or would it be better to use a mixture of soft, with the pea coal?

10—35. When a station is to supply about 300 kilowatts in 60-cycle-polyphase load and about 100 kilowatts in railway load, is it better to use a motor generator or an engine-driven generator for the railway load?

***10—37. A heavy 230-volt short-circuit occurred on the line of a three-wire private plant. One 230-volt generator and a balancing set**

were in operation. The short-circuit burned out five sections of the balancer set starting box. How could this occur, both generator and balancing set being protected by circuit-breakers?

12—28. Will some member company which has used concrete poles tell something as to results and costs?

13—10. What method do other companies use to determine the location of a poor joint on an Edison feeder that will not carry load, but will still carry current enough to give full-voltage reading at its terminal?

13—11. What cable pitches do the various companies use? What were the determining factors?

13—12. What companies use cables of over 1,000,000 cir. mils cross-section?

*17—28. Will some one suggest an efficient method of lighting mean spherical candle-power of the following forms of light during the average life of the appliance? Assume oil at 10 cents per gallon; gas at $1 per M.; electric power at 10 cents per kilowatt-hour.

Kerosene oil, Rochester burner lamp.

Flat-flame Bray burner, 18 candle-power gas light.

Welsbach upright burner, 18 candle-power gas light.

Tungsten lamp, 60-watt size, 1.25 watts per candle-power.

Enclosed arc light.

17—28. Will some one suggest an efficient method of lighting moving-picture studios which shall also be economical? Lighting must be shadowless and permit instantaneous photography. Reflectors shooting sharp rays of light cannot be used. Size of studio, 15 feet wide, running in length from 12 to 17 feet. Height, 8 feet. Present system uses arc lighting of 700 amperes at 110 volts, cost $12,000 to install and is very expensive to use. Tube lighting has been tried and found wanting. It possesses actinic properties but is not sufficiently concentrated. This is a growing class of business and will repay some study.

19—41. What experience have member companies had in allowing polyphase motors to be started with resistance devices in the primary instead of the ordinary auto-transformer?

20—69. We were greatly astonished to be informed by a large manufacturer of meters, that no other central station had ever requested them to increase the size of the registering train dials.

We feel that larger dials would greatly facilitate the reading of meters and reduce errors. If all the central-station managers, who feel as we do, will write the editor of the "Question Box," it may be possible to bring about the desired change. How many would like to see the dials larger?

20—72. What has been the experience of member companies with polyphase rotating testing standards?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

22—35. What has been the experience of companies with flat-rate lighting contracts for long-hour burners, and residences, by using excess indicators or flat-rate controllers? Is the maintenance of these flat-rate controllers equal to or less than the integrating watt-meter?

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given?

Are there any member companies giving off-peak rates or lower rates for cooking?

23—18. What percentage of the total number of customers connected, are disconnected, annually, for non-payment, in companies which have 10,000 customers or more?

23—19. What percentage of the total number of contracts with new customers, in companies having 10,000 or more customers, are accepted without a guarantee deposit?

23—20. In power plants from 100-kilowatt to 1000-kilowatt capacities where there have been both a modern steam plant and a gas producer plant, how do the total costs per kilowatt generated compare?

24—34. Do member companies furnish memorandum meters free of charge or is a rental charged for each meter, and if so, how much, where current is furnished to the owner or lessee of a large building who resells the service to the various tenants; such as office buildings, etc.?

24—35. How many credit men does it require to handle the total business of a company with 10,000 or more customers, and what is the method of passing on this credit?

National Electric Light Association

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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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CONTENTS

UTILIZING THE WATER POWERS

When it is considered that nearly 1,000 American central stations depend on water-power, wholly or in part, and that a large portion of the later development of electrical energy is based on costly water-power systems, it will be admitted that the National Electrical Light Association has a very vital stake in the determination of the questions that have arisen during the recent notable movement for "conservation." When it is remembered that a very large proportion of private water-powers is already developed and that by the withdrawal of nearly 1,500,000 acres of public land power sites, hydro-electric development has almost come to a standstill, it will again be conceded that this Association has laid upon it a solemn duty to bring back into utilization the one "natural resource" that will enable us to "conserve" all the others, without in any degree lessening its own potentiality for good during the ages to come.

The National Electric Light Association, through its member compa-

nies, being a consumer of power in enormous quantities, is thus particularly interested in the problems relating to the lands which can be used for the development of electrical energy. There is probably no class of development as varied in character, cost, and results to be achieved; none other quite so complex and involved. Localities, markets, uses, political and geographical conditions are alike in no two instances. This peculiar situation is altogether too little comprehended except by those who have given special study to the subject, and it is really deplorable from the standpoint of national prosperity and the welfare of vast western regions that the "agitation" on the subject has been so misinformed.

It is doubtful whether any general law can yet be enacted to cover this situation as a whole, which might not discriminate favorably to some localities while being absolutely prohibitive to others. Certainly the question cannot be passed upon unless a full and complete review of all aspects of the question is had; and for this reason the Executive Committee of this Association has adopted the series of important resolutions printed herewith, asking Congress to appoint a Commission of Inquiry to go over the whole ground, with a view to the enactment of helpful legislation.

It is hoped that members of the Association will bring these resolutions to the attention of their respective Senators and Congressmen, asking for their co-operation; and a special letter is being sent to all active member companies asking that they will do this. It is a common cause, and a public cause; for the proper development and conservation of water-power is of incalculable benefit to all the people. The present session of Congress is a very short one; and it is self-evident that the situation demands promptness of action in regard to this, one of the most pressing of the national questions of the day. Our coal, oil and wood are being burned up at a frightful rate. Our water-powers are mostly running to waste. Let us stop at least one form of extravagance!

THE NEW SCALE OF DUES

It is desired to direct attention to the new scale of dues under which bills have been sent to the members this month. This scale was adopted at the St. Louis Convention, 1910, and is now in full force, but it seems likely that its purport and points are not yet fully familiar. One of the main features is that all entrance fees have been abolished. All companies and individuals come in without an initiation charge of any kind. The next point is that the old subscription fund for the annual convention has been abandoned, and th

expenses of special printing, travel, postage, entertainment, etc., are primarily to be taken care of by an assessment of one one-hundredth of one per cent on sales of electrical energy, on companies serving communities of 25,000 population and upward. From $12,000 to $15,000 is needed for such expenses, and it is believed this will meet the requirement. The regular or fixed scale of dues for all companies has been slightly adjusted, starting from a base line of $10 and, in view of the percentage assessment, lowering the amounts at the upper end of the scale. The contributions of manufacturing companies (Class D) to the convention fund are taken care of by a per capita charge on each representative at the convention. This is the method of other Associations. All individual members—Classes B, C and E, pay only $5, receiving the BULLETIN, Proceedings, Handbook (on entrance), and other new literature, the list of which is steadily growing.

It is hoped this brief summary will help explain matters to anyone in doubt, but we shall be glad to forward a copy of the revised constitution on request. It is, of course, to be remembered always and all the time that this is a co-operative body, and that the income is spent in trying to do the greatest good for the greatest number of members. The larger the number of members in good standing, the better the mutual service that can be rendered.

JANUARY MEETING OF THE EXECUTIVE COMMITTEE

A meeting of the Executive Committee was held at the Association offices on January 12. Present: W. W. Freeman, president; Charles L. Edgar, W. C. L. Eglin, Dudley Farrand, John F. Gilchrist, George H. Harries, Arthur Williams, Albert R. Granger, Alex. J. Campbell, W. H. Blood, Jr.; Frank M. Tait, Herbert Wagner, Frank W. Frueauff, R. M. Searle, T. C. Martin, secretary.

Mr. C. H. Hodskinson, master of transportation, was present by invitation.

The minutes of the October 13 meeting were read and approved.

After discussion regarding the coming convention, on motion of Mr. Edgar it was voted that the convention be held in New York City from May 29 to June 2 and that there be two sessions on the last day. The secretary then read the names of the Hotel Committee, as follows: Frank W. Smith, Chairman; E. A. Baily, W. E. McCoy, L. A. Coleman, T. C. Martin and Walter Neumuller; also the Papers Committee as follows: W. W. Freeman, John L. Bailey, W. C. L. Eglin, Frank W. Frueauff, T. C. Martin, D. B. Rushmore and George Williams. The president stated that Mr. Arthur Williams had consented to take the chairmanship of the local entertainment committee.

The secretary read letters regarding the convention daily. After discussion, on motion of Mr. Eglin, it was voted that the matter of the convention daily be referred to the president with power.

Mr. Hodskinson reported transportation conditions, stating that it was possible that the Association would not be able to secure special

rates owing to Interstate Commerce difficulties.

The secretary read the financial statement as of January 1, 1911, showing a balance of $3,436.46, exclusive of $5,000 deposited in Old Colony Trust Company, $5,146.53 invested in Commonwealth Edison bonds, and $4,983.89 in Minneapolis General Electric bonds. He also gave the following comparisons: Receipts for 1909, $40,157.63; for 1910, $58,-145.91. Disbursements for 1909, $42,094.04; for 1910, $62,125.74. Balance, January 1, 1909, $9,500.44; January 1, 1910, $7,564.03; January 1, 1911, $18,566.88, inclusive of investments and deposit in Boston.

On motion of Mr. Edgar, it was voted to pay the bill for printing the 1910 proceedings, amounting to $13,-410.25, of which $1,500 had been paid on account.

The matter of dividing the membership and the proceedings into sections, so that a member would normally receive only the literature in which he is particularly interested, was discussed at length, but no action was taken.

On motion of Mr. Edgar, it was voted that the officers be empowered to pay the reasonable bills for expenses of the organizations and committees, such as the Power Transmission Section, the Lightning Protection Committee, and others.

The membership report showed total membership of 6203, grouped as follows: Class A, 907; Class B, 4329; Class C, 16; Class D, 217; Class E, 734.

Applications from 22 Class A member candidates were read and approved, also three Class D's. These were elected, also 686 Class B members and 16 Class E's included in the above totals.

The question of extending the section membership where the company section membership is too restricted and the section desires to invite to its meetings those interested in outlying fields of the industry was then discussed. On motion it was voted that this matter be referred to the Committee on Section Organization.

Invitations to hold the 1912 convention in Portland, Ore., were discussed. On motion of Mr. Edgar, it was voted that it was the sense of the committee that the time had come to have a convention on the Pacific Coast. Mr. Campbell read the following abstract from the minutes of the meeting of the New England Section: "The opinion was expressed and heartily endorsed that so large and comprehensive an Association as the National body should not confine its meeting places to east of the Rocky Mountains, but should demonstrate, especially to the people of the West, that it is a national body and has the interests of every part of the territory in mind. The belief was expressed that to hold the annual convention in Portland in 1912 would be a practical, comprehensive demonstration of this broad, comprehensive interest." On motion of Mr. Williams, it was voted that a committee of three be appointed by the chair to consider specifically the question of holding the 1912 convention on the Pacific Coast. The president appointed Messrs. Gilchrist, Edgar and Blood.

Mr. Blood gave his report on the circular letter recently sent out to all Class A members and to about 250 fire insurance companies, regarding the resolutions adopted at the St.

Louis convention on the excessive rates charged by the insurance companies. He also made a statement as to liability insurance.

The question as to whether the Association should print some standard forms of accounting, to correspond to the system recommended by the Accounting Committee, was referred back to the Accounting Committee. Mr. Wagner stated that he hoped to get the Maryland Public Service Commission to adopt our classification.

Referring to the action taken by the Executive Committee to hold a conference on resuscitation from electric shock, the secretary read resolutions adopted at a conference held on January 11. On motion of Mr. Williams it was voted to leave the matter in the hands of the president with power to appoint a committee to make nominations as to the personnel of the Medical Commission to make recommendations on the subject.

The committee then adjourned to the Engineers Club to meet with Mr. Henry L. Doherty, chairman, and the following members of the Power Transmission Section: Messrs. S. Z. Mitchell, J. R. McKee, D. B. Rushmore and C. F. Wallace, at which certain resolutions herewith annexed were adopted unanimously by the committee after a very full and interesting discussion.

The Papers Committee, under the chairmanship of President Freeman, has already "got busy" and has been laying down the lines for the proposed four full days of business session at the New York Convention, May 29-June 2. There will be some special features, some papers of notable excellence, but the main idea will be to review the progress and status of the art by the reports of committees.

The Association and the Water Powers

As elsewhere noted in this issue, the Executive Committee of the Association, at its meeting on January 12, adopted a series of resolutions as to the water powers on public lands. These are given below:

Whereas the condition of the laws and regulations relating to the public lands of the United States Government is so complicated, unsatisfactory and unsettled, that the financing and commercial development of new enterprises in connection with public lands is rendered practically impossible; and

Whereas the immediate development of the idle water powers of the nation is of importance to the whole people in that it brings to immediate use an indestructible natural resource that would be otherwise lost or idle and conserves coal, oil, gas and other fuels that are limited in amount and not subject to replacement; and

Whereas the National Electric Light Association is particularly interested in the situation pertaining to public lands of the United States in connection with the development of water powers; and

Whereas much of the difference of opinion upon the subject of water powers arises from the difficulty of obtaining a clear comprehension of all the facts:

Now, therefore, be it resolved: That this Association does respectfully urge that a competent commission, composed of members of the Senate and the House of Representatives of the United States, together with persons familiar with the financial and other practical aspects of the situation, be appointed with full authority to collect the evidence, and

for that purpose to hold full and complete open hearings in different sections of the country; and be it further

Resolved: That this Association does respectfully urge that such commission be appointed at as early a date as possible to the end that its meetings may be held between the adjournment of the present session of Congress and the reassembling of the new Congress in the hope that such commission should report upon such reassembling, and Congress be thereby enabled to take prompt action in the enactment of such laws as will permit the development of the natural resources of the country in such a manner as shall render them of the greatest possible use to all of the people.

Biennial Meeting of the Underwriters Electrical Committee

The biennial meeting of the Electrical Committee of the Underwriters National Electrical Association will be held in March, 1911, in New York City. The day and place of the meeting will be announced later.

As usual, the provisions of the National Electrical Code as they now exist will be the principal matter for consideration, and it is requested that any desired change in, or addition to, the Code, also all sub-committee reports, be forwarded to the association at once, in order that they may be printed in the bulletin, the committee and other interested parties thus having opportunity to consider the same in advance of the meeting.

Final action on suggestions not received in season for consideration by the committee before the meeting, can only be taken by unanimous consent.

As heretofore, the meeting will be open to all interested, and such persons will not only be welcome, but are urged by Mr. C. M. Goddard, secretary, to be present and give the committee the advantage of their experience and advice.

With regard to the above notice of an important meeting, it is desired that suggestions from the N. E. L. A. members with reference to changes in the Code, or additions to it, be forwarded to the Association's insurance expert, Mr. W. H. Blood, Jr., 147 Milk Street, Boston, so that he can arrange to have them properly incorporated in the bulletin above referred to which the underwriters get out, and also in order that he may be able to present them at the meeting with the underwriters.

Overhead Line Construction

Chairman Farley Osgood, of this Committee, reports further work on December 28 and January 11, with all-day sessions; also co-operation with the High-Tension Transmission Committee of the American Institute of Electrical Engineers. Perhaps the work of this technical committee is now farther along than that of any other; at any rate, part of its data and conclusions is already in type. At its last meetings the general propositions were gone over once more, and the "crossings" specifications have been printed and approved in "advance" copy form and are being circulated. The Committee now contemplates the preparation of a large number of special drawings as a necessary component of the report and supplement to the text.

Underground Construction

A new committee in Association work is that on Underground Construction, its chairman being Mr. W. L. Abbott, who is also a member of the Prime Movers Committee, following whose sessions on January 11 a meeting was called at New York headquarters on January 12. The members of the Committee are: Messrs. W. L. Abbott, P. Torchio, H. H. Alverson, G. W. Cate, Burton French, and S. J. Lisberger. It is felt that the work of this new body is in many respects parallel to that of the Overhead Line Construction Committee, and of equal importance to some of the largest companies; and the Committee, by its activity and energy in addressing itself to the matter, bids fair to accomplish some extremely useful results in its reports and recommendations this year.

Committees On Prime Motive Powers And Apparatus

Under the chairmanship of Mr. I. E. Moultrop, the Prime Motive Powers Committee and the Electrical Apparatus Committee held a joint meeting in the rooms of the Association on January 11 to plan the work for the current year. After a forenoon session as a general committee, in which the course of each body was outlined, each committee adjourned to a session of its own. The Prime Motive Powers Committee then went over its subjects in detail, and assigned various features of the work to each of the members. It was very gratifying to the chairman to have a full attendance, all present being desirous to follow up the splendid record already made in this important department of Association activity.

Commercial Section Sub-Committees

Mr. George Williams, the chairman of the Commercial Section, has been engaged for some time past in mapping out systematic work for the section and in organizing a series of sub-committees to undertake it. It is proposed that the convention work of the Commercial Section shall consist chiefly in the consideration and discussion of these reports, and the personnel of the sub-committees ensures a series of valuable contributions to the literature and data of the industry. The list is given below:

Electric Vehicles—Messrs. J. T. Hutchings, Chairman; C. E. Michel, W. H. Blood, Jr.; J. N. Walton, G. H. Jones, Harvey Robinson, P. D. Wagoner, S. H. Smith, W. G. Bee, John R. Williams, E. E. Higgins, F. M. Tait.

Membership—Messrs. J. Robert Crouse, Chairman; Chas. B. Burleigh, W. R. Collier, Edw. E. Bailey, J. C. McQuiston, Duncan Campbell, L. D. Gibbs, L. D. Mathes, L. W. Dickson, O. H. Hogue.

Industrial Lighting—Messrs. M. S. Sloan, Chairman; C. H. Stevens, J. S. Codman, B. P. Fischer, W. D. A. Ryan, H. J. Tait, B. C. McNabb, J. E. Harsh, W. E. Cole, G. F. Keech.

Electricity in Rural Districts—Messrs. John G. Learned, Chairman; E. P. Edwards, J. E. Schuff, S. M. Kennedy, J. Lukes, A. G. Langworthy, H. L. Montgomery, Herman Russell, H. J. Buell.

Advertising—Messrs. C. W. Lee, Chairman; J. C. McQuiston, P. S. Dodd, John F. Gilchrist, Howard K. Mohr, Cyril Nast, F. H. Gale, M. S. Seelman, Jr.; Wm. H. Hodge, H. C. Porter, E. E. Whitehorne, J. M. Connelly, J. W. Hancock, M. E. Turner.

Sign Lighting—Messrs. E. E. Callahan, Chairman; H. I. Markham, Henry Schroeder, I. W. Phillips, Fred Schornstein, Glenn R. Trumbull, E. A. Mills, G. E. Williamson, A. K. Young.

Functions of a Sales Dept.—Messrs. T. I. Jones, Chairman, A. A. Pope, Jos. D. Israel, J. F. Becker, Jr.; E. W. Lloyd, Fred D. Adams, Harry N. Mc-

Connell, E. J. Kulas, Wm. A. Donkin, M. W. Offutt, Arthur S. Huey.

RESIDENCE BUSINESS—Messrs. Clare N. Stannard, Chairman; Douglass Burnett, J. F. Becker, Jr; R. W. Rollins, R. R. Young, G. C. Osborne, P. H. Kemble, W. F. Lyon, A. T. Holbrook, C. Walter Jones, M. C. Osborne.

IMPROVED WIRING AND EQUIPMENT STANDARDS—Messrs. M. C. Rypinski, Chairman; C. H. Stephens, G. M. Sanborn, H. Gest, Dana Pierce, H. R. Sargent, S. E. Doane, A. E. Williams, D. H. Burnham, E. R. Knowles, A. E. Wells, F. V. Burton, F. J. Petura.

COMPETITIVE ILLUMINANTS—Messrs. H. J. Gille, Chairman; G. A. Sawin, F. H. Golding, W. E. Quillin, E. E. Noble.

POWER—Messrs. E. W. Lloyd, Chairman; C. E. Nichols, Newton T. Lewis, H. A. Waite, J. H. Rutherford, R. A. MacGregor, John Meyer, C. A. Graves, C. E. Varney, Chas. Robbins.

The Growing Membership

A list follows of the members elected on January 12, together with those reported in previous issues of the BULLETIN in November and December. It is needless to point out that the present list indicates a marked activity with the coming of the new year, the present list bringing the membership up to 6203. As a matter of fact, even as the BULLETIN goes to press the membership has reached a total of 6425, but the added names must necessarily go over until the February issue, by which time they will be reinforced by many others. There is activity and interest all over the country, and several new company sections are being formed. Chairman Scott, of the Membership Committee, has also just finished a most sweeping preliminary campaign in regard to over 3000 Class A central station company prospects, by special letter, circulars and copies of this journal; and the good results are already being seen. The next steps in this campaign are now to be taken, and both by the members of the Scott Committee and by appeal from headquarters, the "prospect" will be reminded.

New Members

Class A: Monett Electric Light, Power and Ice Co., Monett, Ark.; Simsbury Electric Co., Simsbury, Conn.; Foxboro Electric Co., Foxboro, Mass.; United Electric Securities Co., Boston, Mass.; Goodrich Falls Electric Co., Intervale, N. H.; Laconia Gas and Electric Co., Laconia, N. H.; Jones and Linscott Electric Co., Lancaster, N. H.; Albany Southern Railway Co., Albany, N. Y.; Mount Morris Illuminating Co., Mount Morris, N. Y.; Suburban Light and Power Co., Maumee, Ohio; Pacific Power and Light Co., Portland, Oregon; Penn Central Light and Power Co., Altoona, Penn.; Delta Electric Power Co., Delta, Penn: Anderson Water, Light and Power Co., Anderson, S. C.; Yankton Light, Heat and Power Co., Yankton, S. D.; Frank A. Kennedy, Windsor, Vermont.

Class B: Northern Connecticut Light and Power Company, Hartford, Conn.—Harrison B. Freeman, Jr.

North Shore Electric Company, Chicago, Ill.—Wayne L. Beden, Horace Berther, C. Russell Clapp, Charles Devine, Edwin G. Hindert, W. A. Hirt, John M. Lee, R. Ruswick.

Bangor Railway and Electric Company, Bangor, Maine.—Wallace W. Hern.

Consolidated Gas and Electric Light and Power Company of Baltimore, Md.—Charles H. Clarkin, Chester C. Coster, William G. Dietrich, W. Raymond Ehlers, E. M. Ellsworth, Herman Grothaus, A. B. Grubmeyer, Arthur W. Hawks, Jr., George Hirsch, Edward W. Jahn, Thomas O. Jones, Joseph T. Kane, Joseph T. Kelly, Jr., Lawrence LeGourd, Louis Mardaga, Grover C. Matthai, William H. Miller, Heckert L. Parker, F. M. Weller, Joseph R. Wilfong, Horace P. Wolf.

Edison Electric Illuminating Company, Boston, Mass.—Carl Lamberg, Charles H. Miles.

Cambridge Electric Light Company, Cambridge, Mass.—William F. Goep-

per. Irving H. Jackman, Hugh Smith.

Connecticut River Transmission Company, Boston, Mass.—Cyrene E. Hall, A. W. Latham, Harry W. Whipple.

Haverhill Electric Co., Haverhill, Mass.—Carroll E. Haseltine.

Salem Electric Lighting Co., Salem, Mass.—William P. Verry.

Rockingham County Light and Power Company, Portsmouth, N. H.—William F. Tilton.

Public Service Electric Company, Newark, N. J.—Robert D. Coombs, William Higgins, Herbert J. Hukele, J. A. LeRoy.

Edison Electric Illuminating Company, Brooklyn, N. Y.—I. Oesterblom.

The New York Edison Company.—G. A. Arvidson, W. Fay Bacon, J. S. Cassidy, Herbert J. Fenton, James O. G. Gibbons, Otis Y. Harsen, Lewis A. Howland, Edward J. Kavanaugh, J. T. P. Kenyon, E. J. Lavens, Harry J. Littlefield, George Jos. McCann, J. Frederic Marbot, John W. Marshall, Jr.; John C. Mueller, Frank C. Murphy, Renzo Norsa, Reginald Pratt, Frank B. Rose, S. O. Sandell, Eduard Senn, Jr.; George M. Seymour, William Shipley, W. Steinbach, Lewis B. Streeter, William A. Suter, F. W. Van Sise, W. Weissenberger, Jr.

Narragansett Electric Lighting Company, Providence, R. I.—George A. Seymour.

Niagara, Lockport and Ontario Power Company, Lockport, N. Y.—Ernest C. Udall.

Niagara Falls Electric Light and Power Company, Niagara Falls, N. Y.—Edward J. Carney.

Rockland Light and Power Co., New York, N. Y.—J. M. Davis.

Pacific Power and Light Company, Portland, Oregon.—The Manager, Walla Walla Station.—R. J. Andrus, B. P. Baily, H. R. Kingman, Oral Skiles, F. W. Vincent.

Portland Railway, Light and Power Company, Portland, Oregon.—J. L. Blaisdall.

The Philadelphia Electric Company, Philadelphia, Pa.—Herbert S. Baumann, William W. Benson, John L. Boylan, George A. Brooke, David S. Carson, Samuel H. Corson, Abraham B. Eastwood, Charles B. Flack, W. E. Geddes, Samuel Griffith, John J. Hobler, Harry K. Kirk, Charles Kleinknecht, William F. Koehler, Frank J. Lauer, William J. Lester, Alexander Loos, Benjamin A. Lord, Harry McCauley, John E. McCool, Edwin F. McDevitt, John V. Matthews, Eugene W. Miller, James Milliken, Harold H. Munns, Edward S. Pearson, George R. Paul, William Ploetz, Reginald A. Reamond, John J. Steele, John S. Thomas, Eldred W. Williams, William B. Wood.

British Columbia Electric Railway Company, Ltd., Vancouver, B. C.—William Beer, Rupert H. Bing, F. J. Jordan, A. G. Wilson.

Ottawa Electric Company, Ottawa, Ont.—D. R. Street.

Toronto Electric Light Company, Toronto, Ont.—Clarence Arthurs, Ernest Ayre, C. H. Beavis, R. Bennett, Fred Blakey, William Bourne, A. B. Campbell, J. A. McD. Challes, Warring K. Clark, Arnold W. Cook, H. Percy Cox, Ray C. French, G. S. Gilbert, Frank H. Golding, George Gordan, Alfred Haskell, Arthur W. Hodgetts, Leonard Jewell, Charles D. Ledeatt, William Love, Edwin McBryde, James L. Madigan, Edmund Wm. Murray, William Parkinson, Barton Patterson, George Redman, Harold Shelley, George Sinclair, Robert Villiers, H. Whitham.

Commonwealth Edison Company of Chicago, Ill., 1st list.—Leo James Abel, C. A. Barker, James E. Beehan, Edward G. Bildhauser, Hedge Blomdahl, T. J. Boland, Curtis Booth, T. J. Bresnen, Richard Buracker, Thomas H. Cahill, Albert G. Chamberlain, Harry F. Cook, W. Culkin, F. E. Curren, R. A. DeLong, Harry H. Edward, L. S. English, Eric Erickson, George T. Evens, Veck Forsberg, A. M. Garrett, William J. J. Gleasner, Anton Hansen, Hans Hansen, William E. Harper, Ward T. Huston, H. M. Jacobsen, John H. Jacobsen, R. G. Keating, John J. Kelly, W. T. Kolb, Charles B. Kotz, R. H. Kuhn, Ben Lewin, Roderick Macrae, F. E. Manshreck, G. Marden, Fred Meyer, George Nelson, R. W. Oliver, R. B. Randall, George J. Rau, Arthur W. Rehm, H. L. Richardson, W. S. Rowley, Walter A. Schaefer, Louis A. Seeberger, B. Selleg, T. Shimock, T. B. Stevenson, Edgar R. Stuart, Louis

strength and great protection against electrolytic action on cables.

A paper was read by John F. McGlensey, Illuminating Engineer, Union Electric Light & Power Company, entitled "Light versus Illumination, and the Illuminating Engineer."

By strong contrasting statements the difference between light and illumination was made clear to all, as will be seen in the accompanying quotation:

"Light is phenomena—Illumination is an effect produced by the phenomena of Light. Light is quantity—Illumination is quality. Every central station, every light solicitor, every lamp salesman, fixture manufacturer, shade and reflector house are selling illumination. They are not selling so many kilowatt hours consumption of electricity, so many incandescent lamps, so much light, so many shades; they are selling satisfaction and light satisfaction is illumination." Various lantern slides showed the different methods of illumination, and the nomenclature, the fundamental principles, the photometric standards, and the use of photometric curves were explained in detail. One of the salient points of the paper, stating that more candle-power is produced at the tip of a bowl frosted lamp, equipped with a shade, than with a clear lamp similarly equipped. prompted a very interesting discussion.

At the December 16 meeting Mr. E. G. Reed, Westinghouse transformer expert, discussed transformer history and development, emphasizing the differences between shell and core types, copper and iron losses and phase relations of load and exciting currents. Mr. John Fay, in the discussion, brought out the point that the grounding of a three-phase transformer may make it possible to continue operation as an open-delta arrangement, when one of the phases has been burned out.

With Huntley in Buffalo

One of the pioneers and "prime movers" in the Association is Past President C. R. Huntley, of the Buffalo General Electric Company, who by way of celebrating his practically complete recovery from the dangerous illness that so alarmed his host of friends all over the country, presided at a splendid rally of the Buffalo Section on January 10, when about 150 were present representing all the affiliated companies along the Niagara River. The meeting was presided over by Mr. Geo. W. Ames, the energetic president of the Section, and was addressed on Association work, particularly in its relation to the younger men, by Mr. T. C. Martin, Association Secretary. Admirable speeches were made during the evening by Messrs. C. R. Huntley and George Urban, Jr., the fathers of electric light and power service in Buffalo, both of whom received a most hearty welcome. Among those present also were Messrs. W. R. Huntley and J. E. Montague.

A lunch was given during the day at the Iroquois Hotel to Mr. Martin by Mr. Huntley, attended by many city officials, members of the press, and directors and officers of the Companies. The evening exercises were held in the Ellicott Square Building and then adjournment was made to the Stattler Hotel for supper and

vaudeville entertainment. The Section, though young, is enthusiastic and prosperous, has already had several good meetings and is making ambitious plans for the near future.

Mr. Doherty In Brooklyn On Rates

The January meeting of the Brooklyn Edison Company Section was held on the evening of January 9, in the large hall of the Johnston Building, Brooklyn. There were over 500 employes and visitors in attendance. Chairman, E. A. Baily, presided. In his opening remarks he made the announcement that the membership of the Brooklyn Section had passed the 500 mark and was steadily increasing.

After the preliminaries, Chairman Baily introduced as the first speaker, Mr. Henry L. Doherty, past president of the National Association and donor of the Doherty Gold Medal. Mr. Doherty spoke on the subject of "Rates." His main contention was that electric lighting was a service and not a commodity; that there was a considerable investment expense necessary by the company before it was able to serve a customer, which must be considered in rate making regardless of the customer's actual use of current. The customer of a public utility who uses service only to a limited extent requires as much investment in generating capacity and service mains as the customer who utilizes the same service heavily. The company must at all times be prepared to meet the maximum demands of all its customers, and it is the extent of this maximum demand which has much to do in regulating the cost of supplying service. To charge a customer merely for the amount of current used, if the use is small, would be paralleled by the case of a hotel to which came a customer who reserved say 100 rooms to be occupied at some time during the year not stated, and which during the balance of the year must remain idle, and yet who would only agree to pay for the term of occupancy. Mr. Doherty stated that the proper way to charge for electric service was to institute a service charge regardless of consumption of current, and a small current charge for all electricity consumed.

The next speaker was Mr. T. I. Jones, general sales agent of the Brooklyn Edison Company, who took for his subject, "The Development of Our Business." Mr. Jones began by congratulating his audience upon the fact of their being stockholders in the company, this following the recent announcement of the plan for the division of profits with and among the employes. He then showed by lantern slides some of the methods used by the company in securing business; its advertising; the nature of its contracts and some of the equipments, large and small, which it supplies with current. These pictures included views of the Erie Basin Dry Dock, the Fourth Avenue Subway, the new dry dock at the Navy Yard, the properties of the New York Dock Company, the Bush Terminal Company, Limited, the big Coney Island amusement parks, and a number of other Brooklyn enterprises to which the Edison Company is an exclusive source of electric supply.

At the conclusion of Mr. Jones'

address the following gentlemen, representing the sales departments of their respective companies, spoke briefly: Mr. J. F. Becker, of the United Electric Light and Power Company of New York; Mr. C. A. Littlefield, of the New York Edison Company; Mr. C. G. M. Thomas, of the New York and Queens Electric Light and Power Company, of Long Island City, and Mr. John Meyer, of the Philadelphia Electric Company.

The meeting was then thrown open for a social hour, which included music, vaudeville and refreshments, and was greatly enjoyed by all present. The guests included representatives from the following companies: New York Edison, Philadelphia Section, Public Service Electric of Newark, Consolidated Gas of New York, New York and Queens Electric Light and Power Company of Long Island City, and the Westchester Lighting of Mt. Vernon, N. Y.

The next meeting of the Brooklyn Section will be held February 16.

Fun and Frolic at Toronto

The Toronto Section held its monthly meeting on December 29, 1910. The largest turnout of members for the season occurred that evening, about 120 members being present.

No regular business was transacted, the whole evening being "fun." The first part was a vaudeville entertainment, the second part a buffet lunch, and the closing a mammoth Christmas Tree and a real Santa Claus with presents for each member. The majority of gifts had an appropriate limerick attached to them and many of the "hits" were exceedingly funny.

The Section is to be addressed on January 26 by Mr. T. C. Martin, whose subject will be "Organizing an Industry."

West Penn Annual Dinner

The commercial department of The West Penn Electric Company, with general offices located at Connellsville, Pa., held its second annual dinner at the Yough House, Connellsville, Pa., at the close of its regular monthly business meeting, at 1 o'clock, December 14, 1910. The West Penn Electric Company covers a large territory that is divided up into eighteen districts. The divisions are looked after by nine district superintendents, and each superintendent has his local organization of office force, solicitors, linemen, and electricians. The general office at Connellsville is looked after by W. R. Kenney, superintendent of lighting; C. V. Elliott, chief electrical engineer; E. J. Mora, chief illuminating engineer; T. S. Henderson, new business manager, and assistants. The supervision of all the lighting and power business in the districts is taken care of from this office.

Twenty-two — superintendents, solicitors and heads of the various sections connected with the Commercial Department—attended the dinner, which was a function reflecting great credit on the management. At the close, addresses were made by Mr. W. R. Kenney, who acted as toast-master, and Superintendents C. I. Cottom, J. A. Gafney, T. N. Shaw, W. R. Wallace, R. E. Glass, W. E.

Shaw, D. H. Johnson, and J. S. Johnston. Others who responded were H. L. Mitchell, chief clerk; E. J. Mora; W. S. Anderson, billing auditor; and B. E. Getchell, manager of the meter department.

The affair was a delightful one, the best of feeling prevailed, and the addresses were of such a nature that those who heard them could not help but feel that it is an honor to belong to such an organization and to be an employe of The West Penn Electric Company, one of the most progressive and up-to-date central-station groups in the country.

A movement was started to effect the permanent organization of a section of the N. E. L. A., and as there are some 65 "prospects," it looks as though the purpose will be accomplished very effectively. The Association will certainly be glad to welcome the new section.

Over 700 Commonwealth Edison Members

The movement which was hopefully inaugurated last November for a "bigger and better" Commonwealth Edison branch in Chicago is rapidly assuming the proportions of a land slide, and the officials of the Section are fairly staggered by the rapid growth of the membership, which has now reached a total of 760 members, or a net increase of 62 per cent in two and one-third months. Not only is the membership growing, but the astonishing vigor and enthusiasm of the members is very clearly indicated by the steadily increasing attendance. At the first meeting of the fiscal year, held on December 6, 1910, the attendance was 210; at the second meeting, held on December 20, 1910 —a special meeting rather hurriedly called, and at which, on account of the nearness to Christmas, a large attendance was not expected—the attendance was 234. This overtaxed the capacity of the hall, and the third meeting, on January 10, 1911, was held in a larger hall accommodating 400 people. Notwithstanding the fact that a meeting of the Contract Department was held on the same evening, which diminished the attendance at the branch meeting by at least 75 members, the hall appeared to be comfortably filled, and upon actual count it was found that 306 members were present.

At this meeting two very interesting and instructive papers were presented, first being a "Description of the Generating and Transmission Systems and Load Dispatcher's Office," by Mr. P. B. Juhnke, followed by a paper by Mr. A. E. Evans on the "Sub-Station and Distribution System." Both papers were illustrated with numerous lantern slides, and were greatly enjoyed by the large and appreciative audience. Many of the members took part in the vigorous discussion which ensued, including Messrs. Edwin Jowett, John F. Gilchrist, W. J. Weyker, W. Goodykoontz, G. C. Spencer, U. Davis, D. D. Higgins.

During the brief business session preceding the presentation of these papers a resolution was passed providing for the adoption of a distinct membership badge. A vote of thanks was also extended to the company for the turkeys which it had presented to the employes at Christmas. The chairman an-

nounced that the company had made arrangements to provide complimentary passes to the Electrical Show for all members of the branch, and that Friday night, January 20, 1911, had been decided upon as "N. E. L. A." Night at the show.

The entertainment for the evening was provided by the "N. E. L. A. Orchestra," composed of Messrs. H. P. Smith, M. L. Eastman, P. H. Bardill, J. H. Trunkey, J. N. Schufreider, G. M. Armbrust, F. Mulrooney, M. Rich, W. F. Kleene. who rendered several beautiful selections, and who were tendered a vote of thanks at the conclusion of the entertainment. Mr. R. S. Hale, of Boston, attended the meeting as an interested member of the Section there.

"Edison Life"

This interesting publication, issued formerly by the Edison Club of Edison Electric Illuminating Company of Boston as a monthly, will hereafter be issued by the company itself as a quarterly. The first number of the new series came out in December under the editorship of Mr. L. D. Gibbs, with Messrs. R. S. Hale, C. H. Crockett and C. H. Hodskinson as a committee on publication. It is in character both business and social, and serves as a useful medium for the circulation of company news and data.

Meeting in Salt Lake City

The regular meeting of the Utah Light and Railway Company Section was held in the company offices, Wednesday, December 28, 1910. The gathering was called to order by Chairman W. M. Scott at 8.20 P.M., with fourteen members and two visitors present.

Mr. W. G. Swaner presented a paper on "The New Jordan Steam Station." This was followed by a general discussion of the new steam plant.

Mr. W. L. Emery read an article by Mr. Percy H. Thomas from the Proceedings of the American Institute of Electrical Engineers on the subject of "Lightning Protection." Mr. Allan Maughan read an article by R. P. Jackson from the *Electric Journal* on the subject of "Protection of Electric Circuits and Apparatus from Lightning and Similar Disturbances." The subject of lightning arresters was then discussed in open meeting.

It was voted that the chairman appoint a committee to make arrangements for the annual banquet to be held in February. The chairman appointed a committee composed of the following members: B. W. Mendenhall, C. A. Cohn, O. A. Honnold, E. J. Harvey and C. L. Archer.

Prizes in the Philadelphia Electric Section

The regular monthly meeting of the Philadelphia Electric Company Section of the National Electric Light Association was held in the Assembly Room, 1000 Chestnut Street, Philadelphia, on Monday evening, January 16, 1911. A valuable paper by Mr. G. Bertram Regar on "Incandescent Gas Lighting" was read.

The meeting was also of special interest to the Section, as it developed into a National Electric Light Association "rally." The national president and the national secretary, Messrs. Freeman and Martin, were present, as well as Mr. Seelman,

editor of the National Question Box; Messrs. Granger and Orr, president and vice-president of the Pennsylvania Electric Association, and Messrs. Baily, White and Kemble, of the Brooklyn Company Section. All but Messrs. White and Kemble spoke.

The paper of the evening proved to be most interesting to the electrical interests. Mr. Regar outlined the progress of incandescent gas lighting from its earliest form to the most modern appliances: the various stages being thoroughly described and illustrated with lantern slides. The methods of ignition were treated upon and the paper concluded with a summary of the advantages and disadvantages of gas lighting.

Mr. W. W. Freeman, the president of the National Association, was then called upon, and made a most interesting address, showing the immense amount of good that could be accomplished by unity of action. He stated that the Association had become so large that its best efforts could only be brought to bear by the formation of Geographic and Company Sections, pointing out that this development began during the presidency of Mr. Eglin, of this Company Section.

Mr. Eglin followed with a few remarks on the wonderful growth of the society and the immense amount of good that was being accomplished by the local Section. He laid particular stress on the fact that every member of the body could aspire to the presidency of the National Association, and that it should be the ambition of every member to reach this goal through close study of Company Section and Geographic Section work.

There were present 181 members and guests.

The December meeting of the Philadelphia Electric Company Section was held on Monday evening, December 19, in the Assembly Room, 1000 Chestnut Street. There were in attendance 125 members and guests

The various committees submitted reports, but of chief interest were the reports of the Committee on the Awarding of Prizes and the Membership Committee. Early in the season the Executive Committee offered a prize of $5 to the member securing the greatest number of additional members for that period of the year ending December 15, 1910. The Membership Committee reported 110 new members, 28 of whom were secured by Mr. W. H. Donley, and 17 by Mr. J. J. Sessinger. Mr. Donley was awarded the prize, and honorable mention was made of the splendid work done by Mr. Sessinger.

The committee on the awarding of prizes announced a first prize of $5 to Mr. J. B. Seaman and a second prize of $3 to Mr. W. L. Christ. The winning suggestion applied to the Company's meter department, and suggested the advisability of having all makes of meters standardized in so far as the location of the service and house terminals goes; also suggesting the advisability of a standard coloring for terminals in order to facilitate their connection.

The second suggestion concerned the enclosing, with each receipted bill sent out by the Company to its consumers, of a slip expressing the thanks of the Company for the remittance sent and inviting continued

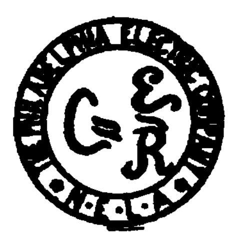
patronage, also suggesting the possibility of printing thereon a small advertisement, the thought being that such a slip would aid in maintaining cordial relations between the consumer and the Company.

The revised constitution, as presented by the special committee, was unanimously approved. The main change covered the formation of departmental branches, in which special work of the Company could be studied. There are already three branches formed, first, The Meter Department, second, The Accounting Department, and third, The Commercial Department. It is hoped by the formation of such branches to interest every employe of the Philadelphia Electric Company each in his own departmental work, and to confine the Section meetings to general topics.

The papers of the evening were "Business Getting," by Mr. J. E. Dougherty, and "Refrigeration," by Mr. R. L. Lloyd. The paper on "Business Getting" was a thorough analysis of the work of the solicitor, citing many experiences of the writer and showing that in some cases it required years to secure a "prospect." The paper was illustrated with lantern slides showing locations in which gas arcs had been displaced by tungsten installations, each of which was analyzed. The paper was enthusiastically received and provoked considerable discussion.

Mr. Lloyd's paper on "Refrigeration" was practically a history of the industry, it being pointed out that in Philadelphia there are more refrigerating machines electrically operated than in any other city in the United States, the Company having been pioneers in this branch of the work. The various methods of refrigeration were described. The first cost of the machinery and the maintenance cost were also estimated upon, and a number of lantern slides illustrating various installations throughout the city were thrown on the screen. These illustrations showed installations in florists' shops, drug stores, ice cream manufactories, restaurants, office buildings, etc. The paper proved most interesting, showing decisively the numerous possibilities in this line of work. A vote of thanks was tendered each speaker.

The Philadelphia Button



Herewith is shown an engraving of the distinctive button adopted by the Philadelphia Electric Company Section. It is certainly a handsome badge. It is just about 9/16 inch in diameter, and embodies, as will be noted, the main features of the regular Association badge—the formula of Ohm's law being surrounded by the words: "The Philadelphia Electric Company, N. E. L. A." The button is stamped up so as to display the city colors in blue and gold, the enameling being very pretty, the central field of gold being surrounded by the light blue border. A fine effect is thus obtained.

Doherty Gold Medal

A number of papers from several company sections have been entered in due form for the Doherty gold medal competition and are now in the hands of the Eglin Committee of Award. That body has begun its work of scrutiny, and to say that the result is awaited with anxiety and keen interest is putting it mildly.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

AS TO DISCONTINUING FREE RENEWALS

Mr. V. R. Lansingh, general manager of the Holophane Company, a capable engineer, an excellent executive and a thoughtful man, has forwarded an interesting contribution which is published this month as a reply to question 24—36.

Mr. Lansingh contends that "The policy of free renewals which was formerly a necessity under then existing conditions, is rapidly growing to be an undesirable solution of the [lamp distribution] problem," this principally because of the introduction of the higher efficiency tungsten filament lamp which Mr. Lansingh says is so "Carefully standardized that there is no longer the same necessity for the central station company to supervise the lamps which are placed on its circuits."

Mr. Lansingh suggests that the sale of lamps might readily be made a source of profit to the electric lighting company, and if free renewals were eliminated, to electrical contractors and supply houses, who would then become more active and willing coadjutors of the central station.

Is this true? Has the time arrived when the central station should strive to be relieved from the heavy burden of its lamp account? Are Mr. Lansingh's premises correct and is his conclusion logical?

Or would such a movement prove an unfortunate step backward, distinctly at variance with those broad-gauge and far-seeing business policies which have made the American central station the most progressive and prosperous in the world? Let us ask ourselves a few questions.

How long would the supply of lamps for this country remain "carefully standardized" if the sale was made competitive through innumerable contractors and supply dealers where the primary object was not as at present, to insure lamp efficiency, and maintain high-class service, but to make a profit on the sale of lamps? As for the average consumer, has not experience shown that when obliged to buy lamps his installation is not adequately maintained?

How long would it take for our lamp practise in this country to deteriorate to a European basis? After five years of such a system would the customer receive anything like as efficient a lamp as is in use to-day? How would the average installation compare with the present equipment? Would not development be retarded rather than accelerated? Moreover, is it not true that the lamp business never was and never will be a profitable one for the average contractor? There are too many different types: too much loss through breakage and careless handling, both on the part of the seller and of customers who hold the seller responsible. Again, in spite of the general introduction of tungsten lamps there is no doubt that some form of carbon lamp will continue to be widely used for many years; also it is inevitable that the price of the metal filament lamp will gradually drop. It has already been reduced between 60 and 70 per cent within three years.

It is true, as Mr. Lansingh says, that the central station makes no money on the sale of lamps, but this is and must necessarily be a minor consideration.

It is the sale of current for profit and not of lamps for profit which should be encouraged. The free renewal practise has been of incalculable benefit to the industry in helping to keep service up to a high standard and inducing the more general use of current. True, conditions change, and practises with them, but arguments must needs be absolutely convincing and conviction copper fastened and brass riveted before the abolition or radical curtailment of this hitherto beneficent and successful system would seem either wise or necessary.

RATES FOR COOKING

There seems to be a very considerable interest just at present (and the number of Question Box inquiries on the subject is one indication of this) in the matter of supplying current for cooking purposes, and as to whether it is advisable in order to encourage this development, to establish special rates for this class of service.

In connection therewith inevitably arises the question as to how to justify such rates so as to convince commissions and courts, to the end that they may be placed in effect without endangering the necessarily higher rates for residence lighting. A central station with a service and a kilowatt hour or primary and secondary rate system of charge is in a position to easily do its share in this development by ignoring or minimizing the cooking equipment as a factor in installation, so that current used in connection therewith will fall under the secondary or lower charge. To the company with flat rates per kilowatt hour the problem is not nearly so simple and such companies have generally felt it advisable to go slow.

As to justification, no business can be secured at a rate greater than the traffic will bear; and courts and commissions uphold the postulate that if the securing of a certain class of business will so aid the diversity factor and improve the load factor of a station as to increase the total efficiency and therefore profit of the entire enterprise, so that all customers may eventually share in the resulting advantage, such class of business may be taken at a rate which will pay its percentage of costs plus a profit, even if such rate is considerably lower than the rates for other classes of service. One of the most striking illustrations of this accepted principle of rate making is supplied by the United States Government itself in the widely varying tariffs on different classes of mail matter.

The point for consideration by central station managers in cities of medium and large size seems to be this: has the time yet arrived when a special rate for cooking can be so justified?—has the development of apparatus reached a stage where the establishment of low rates would result in obtaining the necessary volume of business? It is doubtful if this question can now be answered in the affirmative. It would seem as if the further development of this desirable business, must be left for a while at least to the smaller stations and to such other companies as operate under a system or schedule of rates automatically adjustable to such a situation.

THE "DEPOSIT" TENDENCY

An interesting tendency which has gained considerable headway within the past few years is indicated in the answers to question 23—19, which refers to the percentage of new customers taken by companies without deposit.

This tendency, beyond doubt, is to eliminate the deposit so far as possible, and rely upon increased revenue due to prompter connections and to more thorough and careful methods of collection, to keep down the percentage of bad debts.

Out of eight replies, five companies report that more than 90 per cent of new customers are accepted without deposit, the percentage in the city of Philadelphia being as high as 98. It seems to be a growing opinion that too much attention has been given to and too much time and energy wasted upon this matter of passing on customers' credit, and that it is advantageous in the main to put as few obstacles as possible in the way of the general public doing business with a company.

With this view, your editor is inclined to agree. It would be interesting, however, in connection with these percentage figures on customers accepted without deposit, to have the corelated statements as to percentages of uncollectable bills and estimated increase of revenue due to prompter connections. These are also factors in a comparison of old and new methods, without which no final conclusion can be reasonably reached.

START RIGHT

At first reading, question 17—29 does not appear to be of particular importance, but investigation of the methods of several companies seems to indicate that a condition exists in many central stations in connection with the first installation of service in residences, which might readily be improved.

The questions reads:—"What means do member companies use to insure installation of the proper size incandescent lamps in residences, etc."

How many companies use any means at all? The average practise seems to be to install a 50-watt lamp in every socket, and then if customer requires changes afterwards, to make them.

This does not appear to be a scientific or adequate method, and it might be advisable for companies which are not already so doing, to institute a practise whereby proper size lamps to install in different sockets should be specified in detail by the solicitor securing the contract.

ANSWERS

0—30. This company desires at once any statistics which have been compiled and which are ready to access of the various charges and costs of ornamental street lighting systems which are being maintained in the various cities of the country.

To be of any use, this information must be received promptly.

(See December BULLETIN for other answers.)

The installation cost of ornamental street lighting systems varies greatly, due to the wide variation in the cost of ornamental standards and to the different conditions met in the installation of the underground systems. The following are the costs and maintenance charges in various cities, as they have appeared from time to time in technical magazines.

A. A. Pergande, Engineering Dept.
National Electric Lamp Association
Cleveland, Ohio

[A table follows giving figures for 29 different cities under headings:—"No. of Lamps per Standard and Size;" "Spacing;" "Total Lights;" "Cost of Installation;" "Bearer;" "Schedule of Burning;" "Cost of Maintenance;" and "Bearer." Limitations of space prevent the publication of this comprehensive and valuable contribution here. Any member may secure a copy upon request to Editor of the Question Box.

The general subject of ornamental street lighting is of such current importance that it is probable a special report, of which Question Box contributions will form a part, will be prepared by the Association in the immediate future and distributed to all members.—Editor.]

Following is an extract from the handsome Christmas number of a publication called "Greater Dayton," issued by the Chamber of Commerce, Dayton, Ohio:

DAYTON'S MAGNIFICENT ORNAMENTAL STREET LIGHTING.

"The next few weeks will witness the entire completion of the new system of ornamental or boulevard street lighting. Without a doubt the system installed in Dayton is as cheap and magnificent as any in effect in other cities throughout the country. Dayton has assumed a more metropolitan air since the installation of these lights, and nothing but words of praise are heard from all citizens and visitors. After a period of more than a year, during which time the movement was opposed by some few, the Chamber of Commerce, in conjunction with the Dayton Lighting Company and city officials, has been successful in its efforts. The present lights were installed by an arrangement between the Dayton Lighting Company and property holders and lessees,

to pay the cost of the current until the first of April, 1911, at which time the necessary legislation will have been effected by the City Government. This ornamental street lighting system is one of the biggest improvements made in Dayton for years, and the Chamber of Commerce, through its official organ, *Greater Dayton*, takes this opportunity of commending those who so willingly gave their time and efforts for the successful outcome."

The Georgia Railway & Electric Company is installing a system of ornamental street lighting, using Corinthian columns, manufactured by the Flour City Ornamental Iron Works, at Minneapolis, Minn. Posts are placed approximately 70 feet apart and opposite each other on both sides of the streets. Original installation will consist of approximately 200 posts. Cost of installation is borne by tenants and property owners on the streets along which posts are placed; cost, $1.92 per front foot, divided equally between tenant and owner, each paying 96 cents per front foot. The cost of current and maintenance is paid by the City of Atlanta. Lamps burn from dusk until midnight each night.

William Rawson Collier
Atlanta, Ga.

The ornamental street lighting system in Minneapolis at the present time consists of 510 posts. Each post is equipped with 5-100 watt tungsten lamps with the tip up. Four lamps on the arms burn from dusk to midnight and top lamp from dusk to dawn. Lamps are connected to our underground system and turned on and off by patrolmen. Cost of installation, which has been paid for by property owners and tenants, varied from $125 to $145 per post. Latter price was for the first installation. Price has been gradually reduced to approximately $125. Cost of maintenance is $78 per post per year, which includes current, lamp renewals, turning on and off, cleaning glassware and repainting posts.

H. J. Gille, Commercial Agent
The Minneapolis General Electric Co.
Minneapolis, Minn.

I think it would be well to start in with the story of how this system came into vogue in this city. We have several streets (Main, Spring, Broadway and Hill) devoted to retail business which are equally favorably located. We also have Fifth Street, which leads from the business center of the city to the Southern Pacific Railway depot. The idea of the ornamental post originated with the people on Broadway, who by contribution, or rather promises of contribution, from property owners and storekeepers, succeeded in installing posts the entire length of the street. The plan of voluntary contributions, however, was not entirely successful in view of the fact that some of those who should have contributed most failed to respond, and because of this fact, the

passage of a Municipal Lighting Act by the State Legislature was secured in 1905. This act provides that by petition a street may be lighted and the cost of the installation and maintenance may be assessed to the property owners according to their frontage. Under this act all other streets mentioned above were supplied ornamental posts.

Under past city administrations an arrangement prevailed whereby the property owners paid for the lighting one year and the city paid for it the next year, but the present city government has changed all this and has decided only to pay for one-eighth of the total annual cost of the lighting, it being claimed that this would be approximately the amount the city would have to pay if the streets were illuminated by arcs as are all other streets in the city. The illumination of these posts is divided evenly between the three lighting companies operating in this city.

Up to a recent date the companies made a charge of 3¾ cents per kilowatt hour for the current and supplied free of charge the standard carbon filament lamps and maintained the posts, keeping them clean, replacing all broken glassware, and painting them once a year. Under these conditions the average annual cost of general maintenance approximated $17.60 per year per post exclusive of current.

The posts burn on two schedules—those on the two diagonally opposite corners of intersecting streets and the one in the center of each block on each side of the street burn all night; the remainder of the posts burn until 12 o'clock midnight. The all night lights average 10.48 hours, and the midnight circuit 5.25 hours per day.

The following tables give certain figures of cost which will probably be interesting:—

Street	No. of Posts on Street	Cost of Post Installed Complete Except Service	Cost of Installation of Post per Foot Frontage
Main	103	$116.00	$1.10
Spring	132	110.00	1.06
Broadway	135	103.00	1.00
Hill	164	105.00	.94
Fifth	65	100.00	1.29

The posts with the wiring were installed at the expense of the property owners, but are now the property of the city. The cables, conduits, etc., necessary in serving the system are the property of the lighting companies.

Concerning the 132 posts which this company lights on Spring Street; this is done by means of four conductor cables and two switches (all night and midnight). At midnight one switch is pulled which kills the "Midnight," leaving the "All Night" on until morning.

The entire system is metered in the station, and the meters are adjusted by arrangement with the city electrician so as to be a certain per cent slow. This per cent amounts to the losses between the meters and the lamps, 5 per cent on the midnight and 7.3 per cent on the

all-night circuit. This is done because our contract with the city calls for the delivery of service at the lamps.

Our investment in conduits, from which other business is also taken, was $22,000, in addition to which there was a charge for transformers, connections, cable and labor, made necessary by the installation of the posts, of $8,500.

The posts used were all manufactured by the Llewellyn Iron Works of this city. Experience has shown that in the posts used on Main and Spring Streets and also for Public Buildings, the large center light is too low, and should be raised six or eight inches higher in order to give the best effect on the street, as it is partly obscured by the other globes.

We are to-day entering into a new contract with the city, which is at the rate of 4 cents per kilowatt hour without lamp renewals, the city installing one tungsten lamp of 100 watts in each globe.

The writer believes that these posts should be regarded more as a decoration than for their illuminating value, for the reason that the best effect in store windows is obtained when the illumination outside in the street is not too brilliant.

C. S. Walton
Southern California Edison Co.
Los Angeles, Cal.

8—6. What member companies have installed rotary condensers on their feeders for the purpose of correcting the power-factor? What economies have been shown thereby, also what detrimental results have been demonstrated, if any? Have the advantages offset the cost of making such installations?

Unquestionably rotary condensers will better the operation of almost any alternating current system. This has been found to be true in Cleveland, Hartford, New York and Queens, and many other similar locations. In all these cases economies have been realized by making available greater capacity from transformers, generators and lines, as well as by bettering the regulation of the entire system.

In many cases existing machines are used as rotary condensers, that is, where motor generator sets are used and synchronous motors form part of the set, these machines are used during the day time as rotary condensers.

C. W. Stone, Consulting Engineer
General Electric Company
Schenectady, N. Y.

Power-factor correction is accomplished in four ways:—

Over-excited motor generators at generating station and at some sub-stations.

Over-excited synchronous motors on customers' premises.

Rotary condensers at sub-stations.

Rotary condensers on customers' premises.

Generation and transmission is at 11,000 volts.

Distribution both D.C. and 2300-volt 3-phase.

Motors on motor generator set 11,000-volt, and react on generators and transmission cables only. Synchronous motors on customers' premises are 2300-volt or low tension and react on everything between them and the generators. Condensers at sub-stations are 2300-volt and react on step-down transformers, transmission cables and generators. Condensers on consumers' premises are low tension and react on customers' transformers, 2300-volt lines, sub-station transformers, cables and generators.

Advantages:—

Reduced generator, transmission line, step-down transformer, and distributing line capacity, saving in transmission losses, better operating conditions at generating and sub-stations, better regulation on power circuits. No disadvantages.

General betterment of service and saving in capacity and losses more than offset cost.

Condenser capacity to increase power factor of a circuit above 85 per cent, however, becomes too expensive for benefits obtained.

See *Electrical World*, Nov. 4, 1909.

H. L. Wallau
Cleveland, Ohio

6—1. Would it be advisable to use a 4-valve engine over a simple valve of the same type engine, for a 300-horse-power direct-connected unit with 1½-inch net-and-slack coal at 75 cents per ton delivered in your bin?

We think it would be advisable to use a four-valve engine over the single valve type engine for the 300 horse-power direct connected size, even though the coal costs only 75 cents per ton, providing the speed of both types of engines are alike. The four-valve engine costs a slight amount in excess of a single valve engine and is more economical, enough so to off-set the difference in first cost.

The Hooven, Owens, Rentschler Co.
W. B. Mayo, Secretary and General Manager
Hamilton, O.

The cost of a four-valve engine, 300 horse-power, single cylinder, non-condensing, installed in New York, is about $4740. The cost of the same size, single slide valve engine under the same conditions is about $3900. These prices do not include the cost of foundations. Assuming the four-valve engine uses 25 pounds of steam per horse-power per hour and the single valve engine uses 35 pounds of steam per horse-power per hour, and eight pounds of coal are burned per boiler horse-power per hour, and the price of coal is 75 cents per ton, delivered, the cost of fuel for the two engines for one year will be about $2620 and $3680, respectively. Under these conditions it would be advisable to use the four-valve engine, as the saving in fuel for one year is about $1060 and its extra cost only about $640.

H. M. Cook
Brooklyn, N. Y.

We would advise the use of a four-valve engine, rather than a simple, single-valve engine. Assuming that average load conditions would be experienced, on the basis of 300 horse-power for ten hours per day, 365 days per year, the four-valve engine would show a saving in coal of approximately $500 per year. There would also be 20 per cent less water used, which would be an item in a city plant where water has to be purchased. The saving made in this way would be a very handsome profit on the additional investment.

Ridgway Dynamo and Engine Company
H. A. Otterson, Manager Sales Dept.
Ridgway, Pa.

6—2. What is the saving in fuel of the 4-valve over the simple valve engine, and how does it compare in the way of cost of maintenance?

The saving in fuel of the four-valve over the single valve engine of the 300 horse-power size should be at least three pounds of steam per I.H.P. per hour. The cost of maintenance would be slightly in favor of the single valve engine, but this would be so very small that it would not be worth taking into consideration.

W. B. Mayo, Secretary
The Hooven, Owens, Rentschler Co.
Hamilton, O.

The saving in fuel of the four-valve engine over the single valve engine is about 30 per cent. The maintenance cost per year of the two is about the same.

H. M. Cook
Brooklyn, N. Y.

Under average conditions a first-class four-valve engine will require 20 per cent less steam and fuel than a single-valve, simple engine of the same capacity, and the cost of maintenance should be practically the same in either case.

Ridgway Dynamo and Engine Company
H. A. Otterson, Manager Sales Dept.
Ridgway, Pa.

10—38. Is it a correct thing to do to regulate the field current in a 200-kilowatt synchronous motor driving direct-current generator so that the power-factor remains at unity no matter what the load is? On the machine I refer to, there is no ammeter on the exciting circuit and the operator regulates the field strength according to the reading of the power-factor indicator as stated above. Is this correct or not, and why?

Yes, because the power-factor should be unity at all times.

R. M. Stevenson
Brooklyn, N. Y.

It would undoubtedly be wiser to have an ammeter in the field circuit of a synchronizing motor to guard against excessive field excitation, although in some cases, where motors are specially designed for the service indicated, the fields are built to stand considerable over-excitation.

E. J. Richards
Fitchburg, Mass.

The practise of keeping the field current of a synchronous motor at a point which gives a power-factor of unity, is considered correct, as it is advisable to have the armature amperage as low as possible on account of copper losses, etc. The reading of your power-factor indicator can be roughly checked by adjusting the field current to a point where the armature current is at a minimum for a given load, and any further adjustment of the field strength, whether up or down, will raise the armature current. With this condition, the power-factor will be approximately unity.

Walter H. Millan
St. Louis, Mo.

If the synchronous motor is the only piece of apparatus on the feeder which supplies it, the power-factor indicator will then indicate only the power-factor of the synchronous motor, and the field should be regulated for unity power-factor. If there is any other load on the feeder, and the power-factor indicator shows the power-factor of the feeder, the power-factor indicator should be carried at the best point which it is possible to obtain without overheating the synchronous motor by excessive armature current. Whether the current is excessive, or not, can only be told by an ammeter in the machine armature leads.

J. D. Whittemore
Rochester, N. Y.

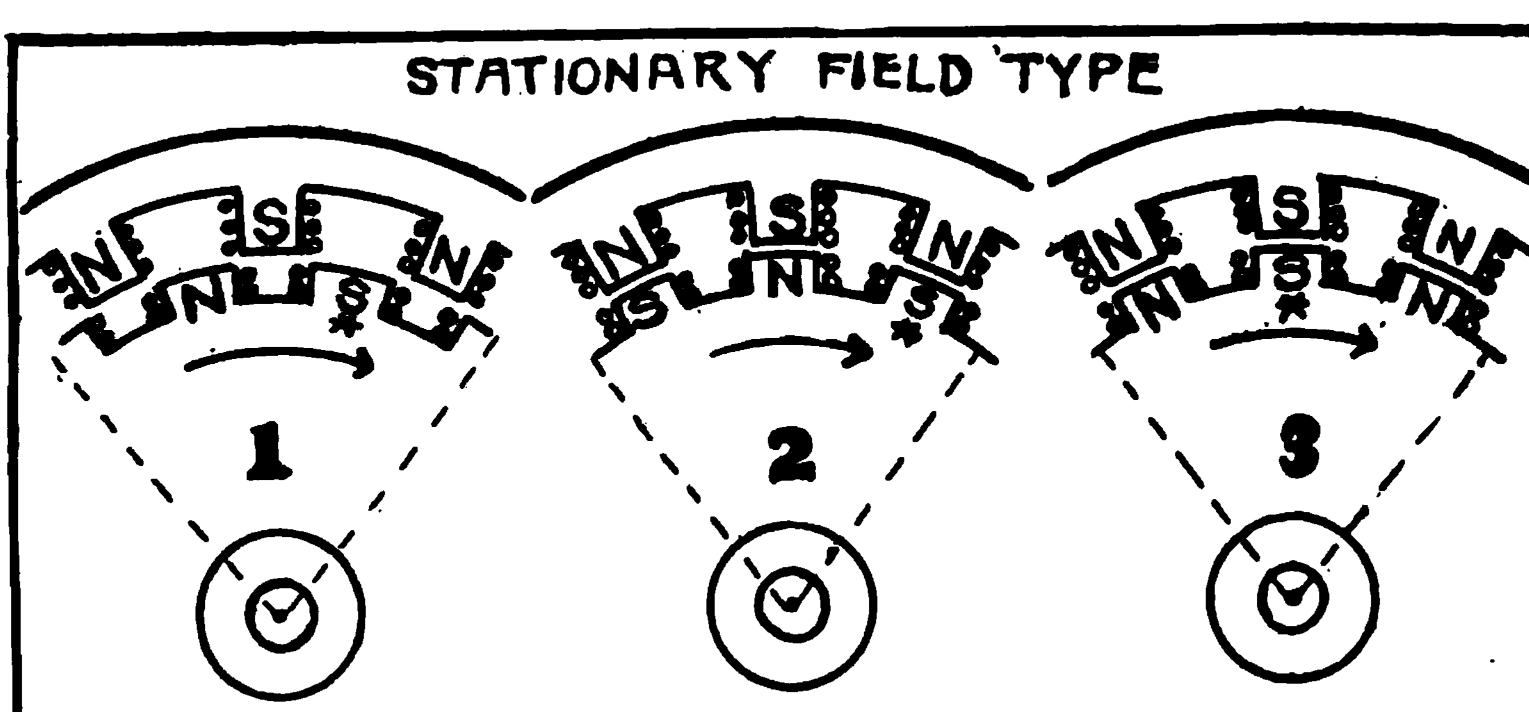


Figure 1 shows relation of armature pole to field pole when current is in phase with voltage. In this position armature poles strengthen the field poles ahead and weaken the field poles just left. The effect on field magnetization is zero.

Figure 2 shows relation of armature to field at maximum current with motor current *lagging 90°*. In this position armature poles strengthen field poles.

Figure 3 shows relation of armature to field at maximum current with motor current *leading 90°*. In this position armature poles weaken field poles.

Assume motor load and supply voltage constant, then at unity power factor, the field flux is a certain value, call it ϕ

If motor actually produces a lagging current, this would increase field flux to say, $+ X$; then by increasing field current gradually the armature would take enough leading current to weaken the flux to $(\phi + X) - X$ or , thus the leading neutralizes the lagging current, establishing unity power factor.

Your operator's method of regulating the field is correct.

S. B. Cushing
Chicago, Ill.

The method of handling this unit depends entirely upon where it is installed.

Case No. 1. Motor generator set installed in generating station to convert part of alternating current output to direct current. Assuming that a majority of the alternating current load on generating station is induction motors, the field of synchronous motor should be adjusted so that motor will carry a highly leading current at all times and thus improve the power factor of the total alternating current load on station. Would recommend that synchronous motor be made to carry approximately full load current, with leading power factor, at practically all conditions of load.

Case No. 2. Motor-generator installed on customer's premises and losses in same being borne by customer. Under these conditions the power factor should be maintained as near unity as possible, to minimize losses in motor. A power factor meter is rather unreliable and adjustment of power factor by comparing field current and current input to rotor is usually found to be more satisfactory.

C. W. PenDell
Chicago, Ill.

11—18. Have member companies experienced any difficulty with moving-picture theatres unbalancing line voltage due to moving-picture arc being on one side of system? On alternating-current circuits are 220-volt economizers used? What are the local Board of Fire Underwriters' rulings in reference to 220-volt economizers?

We experienced some difficulty when the first few moving picture machines were connected to the circuits on 110 volts. This was overcome on these few by placing the arc on a separate transformer, and a rule made whereby all moving-picture arcs would be connected to 220 volts.

The ruling (from The City Electrical Bureau, Rules and Regulations governing the installation of wiring, lighting and apparatus for Picture Show Parlors) is as follows:—

Article XV.—On alternating circuits the following apparatus is recommended for use: Fort Wayne Compensarc, Hallburg Economizer, General Electric Economy Arc, Powers Induction Terminal, Roentgen Controller, Zerveller Controller (latest type only), Mercury Arc Rectifier, and Motor-Generator Set.

Article XVII.—All moving-picture machines to be connected on 220 volts, and, where motor-generator sets are used, the phase and voltage end of motor must conform with the general rules and regulations of The Philadelphia Electric Company.

The Philadelphia Electric Company
Joseph D. Israel, District Manager
Philadelphia, Pa.

Our experience has been that moving picture machines seriously affect the service of other customers in their vicinity if they are connected to one side of a secondary line on alternating current circuits, and in some cases when taken from one side of a direct current circuit. However, the direct current lamps do not use as much current as the alternating lamps and as a rule the direct current mains are heavy enough to take care of a 30 or 35 ampere lamp without serious interference.

On alternating current it is our custom to install a separate transformer for the moving picture machine, the use of a 220-volt economizer being optional with the customer. The use of economizers are subject to the regular underwriters rules covering the installation of rheostats and wiring which is intended to be used on voltages of less than 300.

The incandescent lighting of the theatre is carried on the same transformer with the moving picture machine in order to avoid the installation of two services. Interference caused to the decorative lighting is not objected to by the theatre customers. Wherever possible, the customer is advised to put his incandescent lighting on one side of the three-wire service and the moving picture machine on the other side. This minimizes the interference with the general lighting.

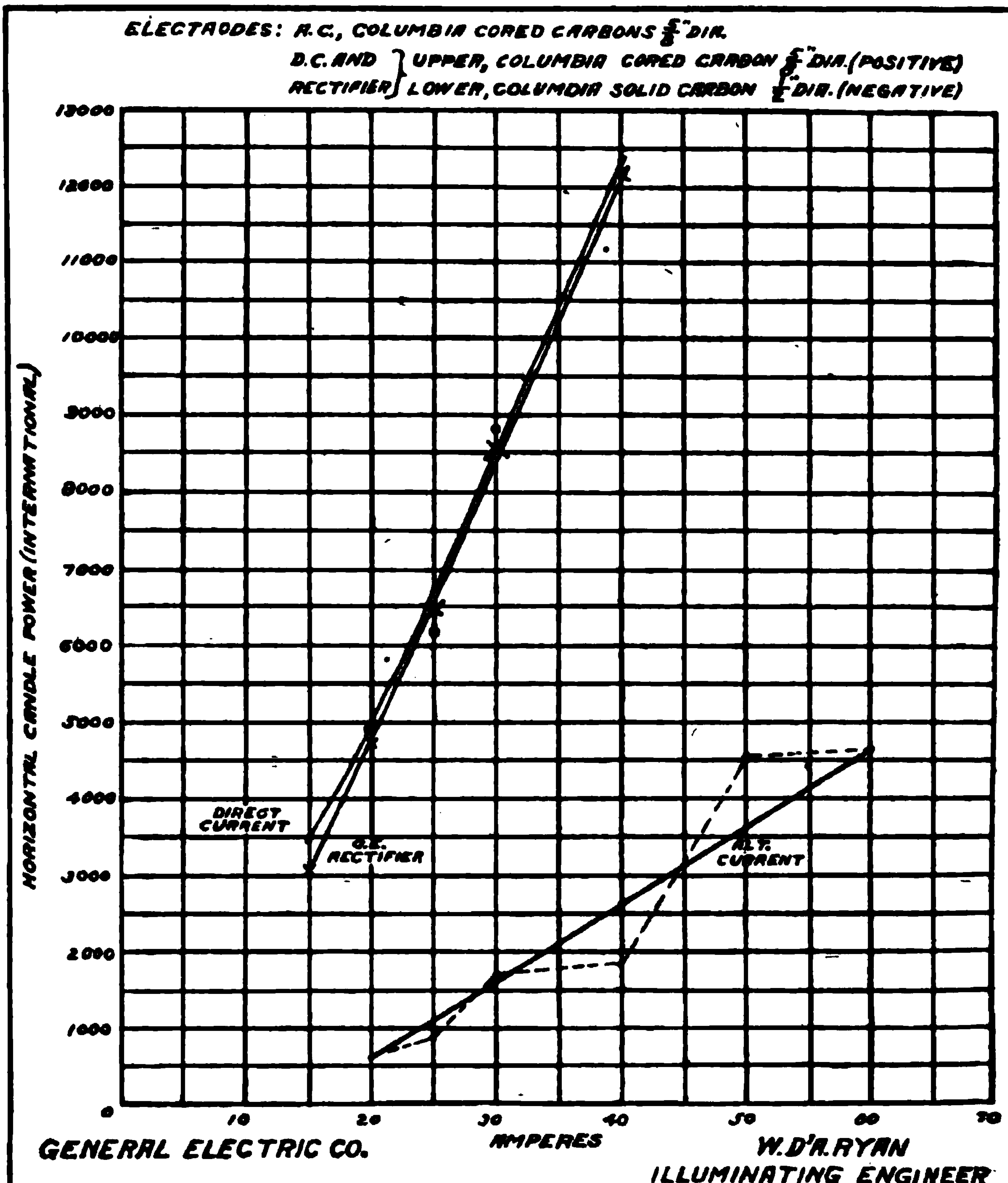
Commonwealth Edison Company
H. B. Gear, General Inspector
Chicago, Ill.

Such hand feed arcs as operated on our 220-volt, direct current system in the business section have caused some unbalancing of the line, our direct current line being 220 to 440-volt, 3-wire service. Due to the large amount of wasted current and the necessity of re-

ducing the voltage from 220 down to the necessary voltage across the arc, a number of economizers have been installed on our 220-volt, single phase circuits, the service of which is much more satisfactory than when operating on 220-volt direct current.

Ross B. Mateer
Denver, Col.

I have heard of complaints of this kind, particularly on A.C. circuits, because of the high current required in the moving picture arc to make even a fairly good light on the projection screen. On



account of this high current, and also on account of the superior light obtained from direct current, a large number of mercury arc rectifiers are now being used for changing alternating current to direct current

for use on moving-picture machines. Thirty amperes direct current in the arc gives a very much better light than 60 amperes alternating current, as will be shown from the accompanying curve. The mercury arc rectifier may be operated on either 110 or 220 V. alternating current circuits. The mercury arc rectifier built by the General Electric Company is approved by the National Board of Fire Underwriters for moving picture service.

R. E. Russell
General Electric Company
Schenectady, N. Y.

The projecting arc lamps used in these places are naturally a disturbing element in any installation, but we have thus far avoided all serious annoyance from them by providing service capacity sufficient to operate the lamps on either side of the system, and if more than one lamp is in use they must of course be balanced to the best possible effect.

The fact that these installations are usually of considerable size naturally calls for a service of ample capacity to easily supply the picture machine when in use, as then the majority of other lamps are not burning, the house being practically in darkness. This last fact is perhaps largely our salvation in avoiding serious trouble from installations of this kind.

I do not know of any 220-volt economizers being used, although it is barely possible that there are such. The local underwriters' and inspection rulings on such economizers would be the same as for rheostats and heating devices in general.

J. W. Cowles
Boston, Mass.

12—36. Our experience has been in case of lightning storms that we have lost transformers close to poor grounded lightning arresters and have not lost a like make of transformer on the same line, but a mile or so away from any arrester, and this leads us to ask the following question: When pole line lightning arresters are properly installed in every way with the exception of the grounding, and that proves to be poor, or the ground wire broken, are such arresters a detriment rather than a protection to the line?

(See December BULLETIN for other answers.)

In the writer's opinion there is no reason why a transformer close to a poorly grounded arrester should be more liable to breakdown than one further removed from any arrester, unless the arrester is of such design as to introduce a reactance which would choke back a lightning surge on the line to seek a path to ground through the transformer secondaries rather than through the poor or broken ground of the arrester. This should not occur with the multigap or other familiar types of line arresters. Badly grounded

arresters are a detriment rather than a protection to the line in so far as they increase the liability of breakdown between phases, when the arresters are connected to a common ground wire.

J. O. Montignani
Rochester, N. Y.

12—38. What effect has the installation of lightning arresters had on the reduction of burnouts and open circuits on both commutator and induction meters? How often is it found necessary to test lightning arresters?

As a result of our investigations during several years, the meter failures have been decreasing to a very considerable extent. We have found that the failures appear to be proportionately less on the distribution systems with secondaries grounded. I am speaking now of distribution systems in general, and as far as the inspection of a lightning protective apparatus is concerned, this should be taken care of at regular intervals, say once a week, and immediately following a storm or disturbance on the system.

B. E. Morrow, Chairman
Committee on Protection from Lightning
Albany, N. Y.

12—39. What method of testing for open circuit is found to be most convenient on arc circuits where tungsten lamps are also used?

Where Mazda-tungsten series lamps are used and these have failed during the day time, the circuit can usually be closed by starting up the constant current transformer, which will puncture the insulating film cutout in the series socket. The lineman can then go out and readily locate the broken lamp. If, however, it is not desired to put the high tension on the series circuit, a brass disc film cutout is manufactured, which will readily puncture at 250 volts. If these cutouts are used in place of the ordinary mica or paper film cutout, a transformer can be arranged to impress, say 400 volts on the series circuit, which will be sufficient to puncture this cutout, thereby making the series circuit again complete. It is usually advisable to insert resistance in series with the transformer to limit the current, when the film has been punctured, to about 10 amperes.

Henry Schroeder,
General Electric Company
Harrison, N. J.

12—40. What method do other companies use to determine the location of a poor joint on an Edison feeder that will not carry load, but will still carry current enough to give full-voltage reading at its terminal?

Disconnect feeder from system and short circuit same througn resistance that will allow enough current to flow to cause arc at poor joint.

T. H. Yawger
Rochester, N. Y.

It is sometimes possible to repair a loose joint on an Edison tube feeder which has not contact enough to carry a load, but enough contact to give pressure reading at the remote end by putting load on the feeder by means of a bank of lamps, gradually increasing this load so that the arc between the coppers of the loose joint will eventually melt the solder and restore a good contact.

Where it is impossible to get the coppers to carry enough load for this purpose, the locating of the loose joint can be proceeded with in the usual manner, that is, to make openings in the street and test from the coupling box in both directions. In making this test the same bank of lamps should be used, the number of lamps should be large enough so that they will light up readily when placed on the end of the feeder not defective, but will not light up on the end of the feeder which contains a defective joint. In case the lights should burn from both ends, the load should be increased until it reaches the point where the lights will only burn from one end of the feeder.

B. E. Strohm, General Foreman
Commonwealth Edison Co.
Chicago, Ill.

18—11. What cable pitches do the various companies use? What were the determining factors?

This company has been using the No. 227 G. E. Filling Compound, and has found it satisfactory.

C. Alcott
Rochester, N. Y.

18—12. What companies use cables of over 1,000,000 cir. mils cross-section?

A list of the users of cable of over 1,000,000 C.M. cross section would doubtless include all the larger companies. The size is, of course, determined by the size units installed and the load requirements of the system. It is safe to say that the advantages of economy in cost and space, secured by using larger cables, would lead companies to use same, where the copper was required, in preference to several smaller cables.

A. S. Mac Dowell
Rochester, N. Y.

Two million C. M. is a maximum for Cleveland.

H. L. Wallau
Cleveland, Ohio

13—13. Is it practicable to operate distributing systems with manhole transformers where manholes are frequently flooded?

Yes, provided subway type transformers are used. Sealing manhole covers with Portland cement makes them practically water-tight.

H. L. Wallau
Cleveland, Ohio

14—5. Kindly give values of the resistance of an oxide battery from beginning to end of charge.

We take it that this question refers to the resistance during charge of a pasted plate type vehicle battery. The initial resistance during charge at normal rate of a Philadelphia thin plate battery, such as is now used in some of the best known makes of electric trucks, increases from .0014 ohm to .0036 ohm during the greater part of the charge; at .0036 ohm the battery is beginning to gas considerably and as the gassing increases, the internal resistance rises to about .01 ohm at end of charge.

E. C. Mulcey, Engineer
Philadelphia Storage Battery Co.
Philadelphia, Pa.

14—6. In some companies the storage batteries are charged during the period of light load and discharged at the time of peak load in order to increase output of station at that time, while in other cases the batteries are kept floating on the system and discharged only in case of trouble. What are the advantages and disadvantages of each system?

The relative advantages of storage batteries in either case are established by local conditions and the class of service in which they operate.

Continuity of service is the most important requirement of light and power companies and large private plants. It is, therefore, of the utmost importance to keep the batteries that are depended upon for this purpose fully charged at all times to insure against interruption. Discharging them temporarily suspends the insurance.

Modern generating equipment is higher in efficiency and lower in depreciation than the storage battery, hence the use of the latter in peak work must have its advantage in special cases only; as for instance, where the peak discharges are of too short duration to warrant installing additional apparatus, or a saving is effected to offset the difference of efficiency and depreciation, etc.

William Yeager
Brooklyn, N. Y.

If the batteries are discharged over the peak less generator capacity is required; if not, then the overload capacity of all generators less the largest unit must be sufficient to safely carry the peak.

If the battery is discharged over the peak, and is practically empty after that, it cannot be used to maintain pressure and relieve generators in case of line short circuits or accident to the generators.

For the greatest guarantee of continuity of service, the battery should be kept fully charged and floating on the line.

H. L. Wallau
Cleveland, Ohio

Similar answer by John C. Parker, Rochester, New York.

15—46. The secondaries of three current transformers, whose primaries are in the three phases of a balanced three-phase circuit, are connected in series, or closed delta, in such a way that the electromotive force of one of them is in the same direction as that of the resultant of the other two. What current will flow in the secondary circuit, and what will be its phase relation?

This question cannot be answered without knowing the design constants of the current transformers referred to. The current which flows depends upon the magnetic characteristics of the iron in each of the transformers. With transformers connected as described, the current flowing through the primaries of the series transformers is largely magnetizing current only. This results in a very large increase in the magnetic density at which the iron is worked, and thereby causes excessive heating of the iron, and eventual burn out of the coils. In certain designs of series transformer there may also be a sufficient rise in voltage, under such conditions, to puncture the insulation. Series transformers should never be connected with their secondaries in series for the reasons above stated.

E. Ballman
Wagner Electric Manufacturing Company
St. Louis, Mo.

I assume this question to refer to the ordinary connection of series transformers used for operating overload relays, as shown in Figure 1. Some of the advantages of this connection over the star connection of the series transformers are that the full load current in the relay coils will be 5 amperes, so that standard coils can be used; that under conditions of unbalancing the current in the relay coils will represent much more clearly the current in each of the lines than is the case with the star connection; that in case any one of the three transformers becomes either open circuited or short circuited, the relay will still receive proper current from the other two transformers. The

phase relation of the currents with this connection is shown in Figure 2, and the current in the two coils of the relay in Figure 3.

H. W. Peck
Rochester N. Y.

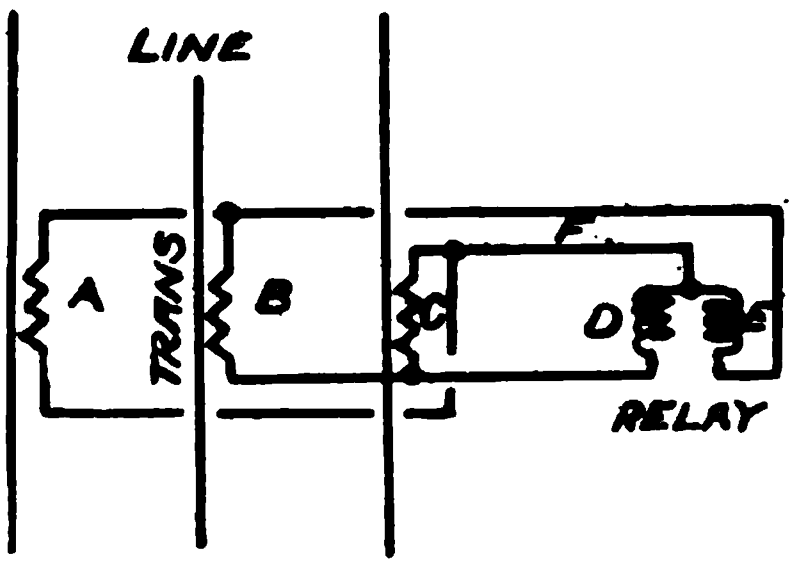


Fig. 1.

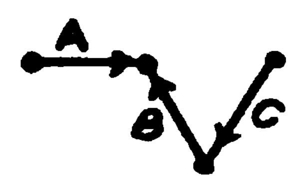


Fig. 2.

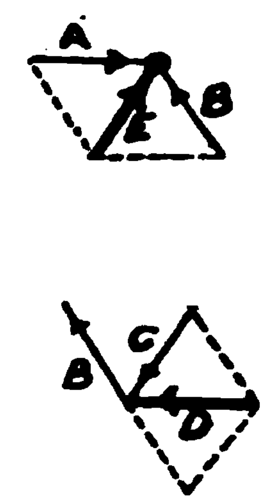


Fig. 3.

15—49. What are the advantages in using air-blast transformers in place of oil cooled, for sub-station work?

Air-blast transformers are used principally where the size of the units is such as to preclude the use of self-cooling transformers, where the cost of water for cooling water-cooled transformers is excessive and where the storage of large quantities of oil is not allowable.

They are not built for voltages exceeding 35,000.

The fire risk is less than that of oil-cooled transformers, but the substantial construction of modern oil-cooled transformer cases greatly reduces the risk, so that damage due to oil catching fire is of rare occurrence.

Air-blast transformers should only be used in stations where there is constant attendance, since the accidental shutting down of the blower supplying the cooling air will cause the temperature of the windings to rise very rapidly, and if the transformers continue to operate under such conditions the temperature may soon reach the danger point.

They occupy less space than oil-insulated, self-cooling transformers, but this advantage is somewhat offset by the space required for the blower outfits, of which there should be two, each of which with sufficient capacity to cool all the transformers in the station, so that one blower set is always a spare and can be put into service immediately in case of a breakdown of the other.

W. M. M'Conahey
Westinghouse Electric and Manufacturing Company
Pittsburg, Pa.

Air-blast transformers are cheaper, lighter and lesser fire risk than oil-cooled transformers. When oil-cooled transformers are located in stations and used on high voltage work, it is generally considered

advisable to place them in fireproof vaults, thereby increasing the construction expenses. The presence of oil increases the cost of repairing and handling, and requires special attention to prevent moisture and foreign matter entering the case.

Oil-cooled transformers are used only where a supply of air is unavailable and oil insulated water-cooled transformers only on very high voltage work.

M. O. Jenkins
New York.

The question of the use of air-blast or oil-cooled transformers is largely a question of fire hazard. Oil-cooled transformers if subjected to intense external heat may, of course, give trouble by burning of the oil. On the other hand, any arc or short circuit which may be formed within the transformer, due to defective insulation or line surges, will be readily smothered by the oil. Air-blast transformers will not give much trouble due to external heat, but in case of a short circuit in any one of a bank, the insulation is quickly flamed into a fierce blaze and the remaining units are set afire, thereby causing the destruction of all. This type is seldom installed to-day, except in places where water is scarce and where the units are too large for the installation of the self-cooled type.

The air-blast transformer is rarely used in installations of over 30,000 volts.

A. H. Timmerman
Wagner Electric Manufacturing Company
St. Louis, Mo.

The fact that no oil is required in or about these transformers appeals to central station managers in the large cities, where every fire risk must be reduced to a minimum. Such transformers can be banked closely together without regard to exterior ventilation. Their appearance is very neat, leads being absolutely brought through the base and air chamber.

Walter S. Moody, Engineer, Transformer Dept.
General Electric Company
Pittsfield, Mass.

15—50. Why are mercury arc rectifiers used on tungsten street lighting systems? Would not the ordinary floating transformers do as well?

Mercury arc rectifiers are not necessary for Mazda street lighting systems. The only cases where they are used on circuits feeding Mazda lamps, are those which have magnetite lamps on the same circuits, the rectifier being necessary for the magnetite lamps. The standard practise for Mazda street lighting system is to use the ordinary type of constant current transformer.

C. W. Stone, Consulting Engineer
General Electric Company
Schenectady, N. Y.

Mercury arc rectifiers are not necessary for use with tungsten filament lamps, as they operate equally well on either direct current or alternating current. The mercury arc rectifiers are used in conjunction with constant current transformers to change the alternating constant current to direct constant current, which is necessary for the operation of luminous magnetite arc lamps. This same current can also be used for tungsten filament series lamps, thereby avoiding the use of two constant current circuits.

Henry Schroeder
General Electric Company
Harrison, N. J.

Mercury arc rectifiers are installed on the 220-volt single-phase circuits, being the two outside wires of our three-wire lighting circuit.

Ross B. Mateer
Denver Col.

15—51. Have member companies found mercury alarm contacts on thermometers used on transformers reliable?

(Four companies report, in the December BULLETIN, satisfactory results with this apparatus.

We have had no experience with mercury alarm contacts on thermometers used on transformers. We have, however, used the standard Bristol recording thermometer with remote bulb. This bulb, which is placed in the oil within the transformer case, is connected by means of a small tube to the meter on the distant switchboard where it can be readily seen by the attendant and on whom we rely to detect excessive temperature rises by this means.

P. Junkersfeld, Assistant to Second Vice-President
Commonwealth Edison Company
Chicago, Ill.

We have furnished the mercury contact alarm thermometer for a number of years and have not as yet received a complaint that it did not give the alarm in case of excessive heating. We have given this style of thermometer numerous tests and have always found it to be reliable.

We have also supplied a capillary mercury tube thermometer which has sufficient length of copper tubing to admit putting the bulb in the hottest spot.

We have also in some cases supplied thermostat so that the circuit will open and give the alarm when the oil reaches an excessive temperature.

Walter S. Moody, Engineer, Transformer Dept.
General Electric Company
Pittsfield, Mass.

Unreliable. Mercury becoming separated in tube opens circuit alarm system.

T. H. Yawger
Rochester, N. Y.

16—21. Is it worth while to use low-voltage tungsten lamps for signs, or is the improvement in high-voltage likely to make the transformer expense unjustifiable?

(Reprinted because of dropping of line of type in last month's publication.)

I do not consider it worth while to use low voltage tungsten lamps purchasing transformers for lowering the voltage for electric sign work.

I have had very gratifying experience operating four tungsten lamps in series on 110-volt circuit, operating the same at an efficiency of 1½ watts per candle. The lamps should be closely assorted as to candle-power which will assure long life.

This I consider the proper procedure pending the advent of low candle-power high voltage lamps, which at present are not in sight.

R. W. Rollins, General Manager
The Hartford Electric Light Co.
Hartford, Conn.

16—22. What is the average cost, operating and maintenance, per mean spherical candle-power of the following forms of light during the average life of the appliance? Assume oil at 10 cents per gallon; gas at $1 per M.; electric power at 10 cents per kilowatt-hour.

Kerosene oil, Rochester burner lamp.
Flat-flame Bray burner, 18 candle-power gas light.
Welsbach upright burner, 18 candle-power gas light.
Tungsten lamp, 60-watt size, 1.25 watts per candle-power.
Enclosed arc light.

Unit	Open Flame	Welsb'h Jr Upright	60-Watt Mazda	In-closed Arc	Kerosene 1¼" Burner	
Actual M. S. C. P.	15	14	40	296	*34.26	
Power consumed per unit in cu. ft. per hour or in watts	5	2	60	550	.042	Gal.
M. S. C. P. per cu. ft. per hour or per watt	3	7	.66	.53	.00121	Gal.
Life of mantle or lamps	—	600	1000	—	—	
Cost of energy per M. S. C. P. hour	.033	.014	.015	.0225	.0121c.	
Cost of renewals and maintenance per M. S. C. P. hour	—	.005	.0027	.0005	—	
Total Cost per M. S. C. P. hour	.033	.019	.0177	.023	.0121c.	

Gas at $1.00 per M. cu. ft. Electricity at 10 cents K. W. hour, and kerosene at 10 cents gal.

*The candle power given for the kerosene lamp is mean horizontal, also the cost given does not include cost of wicks and trimming. The cost of a gas mantle is taken at 25 cents and a 60-watt Mazda at $1.10.

H. W. Brown
General Electric Company
Boston, Mass.

It is difficult to obtain sufficient data on the performance of kerosene lamps under service conditions to determine the operating cost per M. S. C.-hour., but the following are the costs of operation for the remaining units. In each case the average performance under service conditions and during the life of the renewal part has been considered.

Messrs. Lansingh and Cravath in "Practical Illumination" give the initial laboratory M. S. C. value for an upright Welsbach lamp with opal globe as 45. The average laboratory candle-power of an upright mantle during life is about 80 per cent of the initial. (See paper by Norman Macbeth, Trans. I.E.S., April, 1910.) The performance of the lamp is further impaired by the variable gas quality, pressure and atmospheric conditions, and the less careful adjustment which always obtains under service conditions; hence the lamp cannot be expected to give an average performance of more than about 30 M.S.C.

The M.S.C. for the 60-watt tungsten filament lamp is based upon the present rated efficiency of 1.18 w.p.c. The initial value has been discounted 10 per cent. to allow for all conditions which may affect the average performance of the unit.

The initial M.S.C. value for the arc lamp was taken from the average of a large number of reliable tests from various sources. This value was then reduced 20 per cent, since the average performance during the life of the carbons is 80 per cent of the initial. (See Standard Hand Book.)

A comparison of the costs per M.S.C. hour as given will show the relative costs of generating light flux with the several units. The values do not, however, offer a basis for comparison of the lamps as illuminants, which must take into consideration the distribution of the light flux. Less than 50 per cent. of the light from the Bray burner is emitted in the lower hemisphere. About 55 per cent. of the total light flux of the upright Welsbach lamp is in the lower hemisphere, and that largely near the horizontal. The arc lamp with opal globes, as it is generally used in commercial lighting, directs 55 to 60 per cent of its light into lower hemisphere. With the tungsten-Holophane unit a much larger proportion of the light flux is emitted in useful directions than in the case of the other units, and hence its efficiency as an illuminant will be relatively higher than shown by the cost tables:

FLAT FLAME BRAY BURNER

Average burner consumption, cubic foot per hour	5
Annual cost of gas at $1.00 per M., 1000 hours lighting	$5.00
Average M.S.C.	16
Total operating cost per M.S.C.	$0.00031

WELSBACH UPRIGHT BURNER

Average burner consumption, cubic feet per hour	5.5
Maintenance per year, by gas company, at 15 cents per month	$1.80
Annual cost of gas per year, 1000 hours lighting	5.50
Total annual operating cost, 1000 hours lighting	7.30

Total annual operating cost including pilot flame consumption (0.15 cubic foot per hour)	$8.60
Average M.S.C. under service conditions, opal globe	30
Total operating cost per M.S.C. hour	$0.00024
Total operating cost per M. S. C. including pilot flame consumption	0.00029

60-WATT TUNGSTEN FILAMENT LAMP

Life of lamp, hours	1000
Cost of lamp, bowl frosted	$1.17
MAINTENANCE COST:	
Cleaning per year at 3 cents per month	$0.36
Lamp renewals per 1000 hours	1.17
Energy cost per 1000 hours at 10 cents per kilowatt hour	6.00
Total annual operating cost, 1000 hours lighting	7.53
Average M.S.C. under service conditions, holophane reflector	30
Total operating cost per M.S.C. hour	0.00025

5 AMPERE D. C. MULTIPLE ENCLOSED ARC LAMP

Maintenance cost per 1000 hours:	
Electrodes—10 trims at 4 cents	$.40
Trimming and inspection, 10 trims at 10 cents	1.00
Outer globes at 75 cents (2000 hours)	0.37
Inner globes at 10 cents (300 hours)	0.33
Repairs	0.50
	$2.60
Energy cost per 1000 hours, 550 watts at 10 cents per kilowatt hour	55.00
Total annual operating cost, 1000 hours lighting	57.60
Average M.S.C. under service conditions opal inner and opal outer globes	125
Total operating cost per M.S.C. hour	.00046

H. H. Magdstick
Cleveland, O.

16—85. What success, if any, have member companies had with 250-watt tungsten lamps?

For store and window display, and factory lighting, 250-watt tungstens with Holophane glassware are frequently used. It is obvious that the total cost of a few lamps, reflectors, and wiring for same, as well as the maintenance cost of the few large units, looks attractive to the average consumer in comparison to the total expense of a larger number of small units. The writer has in mind an automobile factory and a wood-working shop where 250-watt lamps are used exclusively, and with entire satisfaction. Spring fixtures are used, and the breakage is slight. In the case of the automobile factory the lamps are eleven feet above the floor, and in the wood-working shop,

twelve feet. No drop cords are used, the general illumination being ample. In many cases the light distribution would not be satisfactory with units of this size—especially in buildings where the deep shadows from machinery, belting, shafting, and piping, resulting from the use of too few light sources, would be objectionable. In such cases a larger number of units of lower wattage should be used.

H. C. Stewart
Rochester, New York

The 250-watt tungsten lamp is ordinarily used for illuminating store fronts as well as for window lighting. Some large units of this type have been installed for interior lighting. We find the light to be very satisfactory and the life of the lamps more than equals our expectations.

Ross B. Mateer
Denver, Colorado

We have on our service, a department store which has an installation of 64-250-watt single-light units, supported on chain pendants, suspended fourteen feet from the floor. Each two units of lamps are switched. These lamps were installed in September, 1908, and up to the present writing, this customer has had only twenty burn-outs. The lamps have averaged 1500 to 1800 hours. Our customer is quite particular in having the shades and lamps clean, and the janitor has to wash them quite frequently. In view of this fact, we believe these lamps have shown exceptionally long life.

W. B. Voth, Chief Engineer
Sheboygan Railway and Electric Co.
Sheboygan, Wis.

16—86. How is the efficiency of an incandescent lamp determined?

The first impression on reading this question is that the questioner wishes to find out how to measure the watts per candle of a given lamp. This can be accomplished by the use of photometer, voltmeter and ammeter. The candle power can be measured on a photometer and the voltage and current—and therefore the wattage—determined from the electrical instruments. The quotient of the two, of course, gives the watts per candle.

There can also be another meaning interpreted from the question, viz., how would the efficiency at which a lamp should operate be determined? In general, it can be said that the efficiency at which lamps are rated is such that the total cost of light given by the lamp when energy is bought at ordinary commercial rates will be a minimum. The higher the efficiency is, the less the watts per candle at which the lamp burns, the shorter will be its life and the greater its candle power. For any given price of lamp and cost of energy, there is one particular efficiency at which the two opposing items of cost—energy expense and renewal expense—balance to give a minimum. This figure is not the same for all energy costs, and accordingly, a

lamp of a given efficiency will produce light most economically only at one cost of energy. Most incandescent lamps of the present day are rated at three different voltages corresponding to three different efficiencies—a high efficiency, a medium, and a low. Where the cost of power is high the most economical operation is secured at the top voltage, or high efficiency. Medium and low efficiency are adapted for conditions where the cost of power is respectively moderate or very low. Central stations will find that a high efficiency lamp will yield the greatest net income, *i. e.*, income from sale of killowatt hours minus lamp renewal cost. This is true because the revenue from the increased wattage connected will more than pay the increased renewal expense.

M. D. Cooper
National Electric Lamp Association
Cleveland, Ohio

This question may be answered in two ways:—"How is the efficiency of an incandescent lamp measured?" and, "What determines the efficiency at which incandescent lamps should operate?"

(1) For commercial purposes the efficiency of an incandescent lamp is usually expressed in watts per Mean Horizontal Candle-Power. This, strictly speaking, is the specific consumption of the lamp. It is usually found by placing the lamp in the photometer and rotating it about its vertical axis, obtaining a measure of the average horizontal candle-power. This, divided into the wattage consumed by the lamp, gives the watts per Mean Horizontal Candle-Power. This is not a correct basis of comparing different classes of lamps, inasmuch as the shape of one filament may give greater horizontal and less vertical candle-power. For true comparison between different shapes of filaments the comparison should be made on the watts per Mean Spherical Candle-Power. For lamps of different shaped filaments, a reduction factor is found, which, multiplied by the Horizontal Candle-Power, gives the Spherical Candle-Power. The wattage of the lamp divided by this Mean Spherical Candle-Power gives the watts per Mean Spherical Candle-Power.

(2) The proper operating efficiency of any one class of filament is determined by the life obtained while operating at this efficiency. There are two variables found in the operation of an incandescent lamp—efficiency and life, the increase of one always being made at the expense of the other. In commercial practice, a balance is found at which a good commercial life is obtained, at the same time having the lamp operate at good efficiency. It is a question of balancing renewal cost against energy cost. In Mazda lamps, the general practice is to operate the lamps at such an efficiency as to give 1000 hours average life. This efficiency is found to be most economical, considering the cost of renewals, and the cost of energy.

C. W. Bettcher
Harrison, New Jersey

19—41. What experience have member companies had in allowing polyphase motors to be started with resistance devices in the primary instead of the ordinary auto-transformer?

Three of our suburban companies allow polyphase motors to be started with rheostatic starters, instead of the auto-transformers, up to and including 20 horse-power. We have made several tests of these starters as compared with the use of the auto-starter and do not find that they disturb our circuits any more than starting a motor under the same condition with the auto-starter and they have the advantage of being simpler, easier to maintain and a lower first cost.

Geo. L. Colgate
Rochester, N. Y.

19—42. Do any member companies specify in their motor rules that all alternating-current motors should be of the wound-rotor type to avoid excessive starting current?

The following is a quotation from the Rules and Regulations regarding Supply of Current by this Company:

"All single-phase motors must be self-starting: *i. e.*, they must operate automatically without any control after the switch controlling the motor is once closed and must release at no voltage.

"Motors below 1 horse-power may be for 110 volts, but when connected to the same installation with larger motors and when for 1 horse-power and above, they must be for 220 volts.

"For two-phase service, all motors must be suitable for 220 volts, and for constant speed work; those of the squirrel cage type of five horse-power and above must be equipped with a compensator or starting device which will apply not more than half voltage in starting.

"Variable speed motors of the squirrel cage type below 15 horse-power may be installed without any starting device other than a switch, but those of 15 horse-power and above, must be of the slip-ring type.

"It is recommended that the company be consulted as to the best type of motors suitable for the particular class of work to be done."

Frank W. Smith, Secretary
The United Electric Light and Power Co.
New York City

Such a rule is eminently undesirable, since motors of small size, and especially when lightly loaded, can be thrown on to the line without drawing a starting current which would constitute any appreciable portion of the feeder load, and since the wound rotor type of motor is materially less simple to operate than the squirrel cage type. One must not lose sight of the commercial fact that motors are not thrown on the lines at a time when slight voltage fluctuations are serious, namely, when there is a large demand for domestic lighting, when slight momentary flickering would be objectionable.

John C. Parker
Rochester, New York

The North Shore Electric Company, which furnishes light and power over a territory covering more than a thousand square miles, requires that all motors of thirty-five horse-power, or over, shall be of the slip-ring type to avoid excessive starting currents. The company also requires slip-ring motors in small sizes where automatic control is used, and recommends the use of such motors in smaller sizes where the starting load is heavy.

C. W. PenDell
Chicago, Ill.

20—70. What is the best method of measuring the simultaneous maximum demand for a customer having eight three-wire direct-current meters? The meters are connected from a sub-station bus, to which other customers are also connected.

(See December Bulletin for other answers.)

If it is impossible to feed this customer from an auxiliary bus and install a totalizing wattmeter, install on each of the eight feeders an integrating wattmeter having a printing attachment which will register the consumption every so often; the frequency with which the consumption is registered being dependent upon the maximum demand period established by contract under which customer is purchasing power. Control the stamping devices on all eight meters by a master clock which will cause all registers to stamp simultaneously. The total maximum demand can then be obtained from the sum of the individual registrations.

C. W. PenDell
Chicago, Ill.

21—18. We have been for some time negotiating with a steam railroad for supplying power for the operation of their shops, their requirements being about 750 horse-power. They have asked us for list of the steam railroads who are purchasing power for the operation of their shops in preference to operating their own plant. We have only been able to secure a few of these, and if any of the members have contracts of this character, it would confer a great favor upon us to give us the details of same. Also the amount of horse-power capacity involved.

We are furnishing power to one railroad shop which has a connected load of about 1000 horse-power in motors and about 50 kilowatts in lights. They purchase the power from us at primary voltage, 4100, 3-phase, 60-cycles. The instruments indicate that the average of the five minute peaks is about 300 kilowatts. This railroad shop is operating under, what I would consider, average conditions.

Geo. L. Colgate
Rochester, N. Y.

This company supplies power to the C. P. R. and G. T. P. Railways for all purposes. The former had 2000 horse-power steam electric plant for shops, elevators and coal docks. Steam plant has been cut out, except for yard heating of coaches and fixing up locomotives.

Present demand nearly 3000 horse-power. In their shops they even use their steam hammer by use of compressed air, and get more satisfactory results, especially in cold weather. Are considering its use for blowing up locomotives in round house, etc.

They take delivery at two separate points, and are considering its use at a third point. This railroad company has electrified wherever they possibly can and by their own diversity factor keep reaping increased benefit.

W. L. Bird, Manager
Kaministiquia Power Co., Limited
Fort William, Ontario

We don't furnish any large amount of current for the railroad shops. They have a very large heating proposition, for kilns and shop warming, and wanted us to get below 1 cent. Therefore we could not do business with them. We furnish the Central and D. & H. a great deal of current but mostly for lighting, bridge, elevator-power and fans for ventilation. If we furnished the amount you speak of the price would be 1¾ cents per kilowatt hour.

A. Anderson, General Manager
Municipal Gas Company
Albany, N. Y.

We have recently closed a contract with the Boston & Albany Railroad for supplying all the power for their grain elevators. This will be somewhere in the neighborhood of 2000 horse-power and has been closed on our regular rates.

We supply a very large amount of incidental power in small quantities to various railway stations, etc.

R. S. Hale
Boston, Mass.

While there are a large number of railroads in Chicago, few of them have their main shops here. We sell some power to all the railroads entering the city limits—anywhere from five to two hundred horse-power—but have no customers as large as 750 horse-power in this line of business.

The power requirements of railroad shops are no different than any other large machine shops, the load factors are approximately the same and we would quote them our regular schedules.

E. W. Lloyd
Chicago, Ill.

21—20. How many solicitors should be employed to work a city of 350,000 population, where gas competition is very keen and municipal ownership threatened?

Where one has keen competition, and municipal ownership is threatened, it would require one first-class man per 10,000 of population to get and hold the business he does get, and keep the consumers already on the list. The holding of an old consumer in this case is as valuable as getting two new consumers. Therefore, it is just as important to hold old business through a man thoroughly skilled in the art, and even if he is skilled he can only handle the zone of 10,000 people.

R. M. Searle Vice-President
Rochester Railway and Light Company
Rochester, New York

This depends largely on conditions. If the income is large per inhabitant, that is, indicates a healthy desire on the part of the public to use electricity, a comparatively small number of solicitors would be required. If, however, this income is low as compared with other cities active in the pushing of their business, then a larger number of solicitors would be required.

Normally, twenty solicitors should be able to take care of a company having its share of business in a city of 350,000. However, if the company has a small load as compared with other cities of the same class, it would be money well spent to put on more solicitors, if only for a year or so. The work done by a soliciting force of this size, together with judicious advertising should show very handsome returns. Of course, it will be necessary to have the right sort of man at the head of the contract organization with sufficient experience and authority to carry out well organized plans.

E. W. Lloyd
Chicago, Ill.

This would depend largely on how much of the city is covered with lines as well as the policy with respect to extensions. If the city is not well covered with lines and the policy of the company provides a certain definite amount of money for extensions each year to be spent on the basis of definite estimated earnings per dollar invested for the first year, and the business as a whole is not developed so that a desire for electric service exists, it is a very different proposition from a similar city where everyone in town is eager for electric service and the company willing to make liberal extensions. There is no question but what there should be sufficient men to properly look after the needs of the public so that electric service will be the most economical for general use. I think it is a great mistake to economize on men of this kind. I believe in employing as many men of this kind as can produce results, as it is only by everlastingly keeeping at it, not only

the men on the outside but everyone connected with the organization and properly directed advertising, that results are produced.

H. J. Gille
Minneapolis, Minn.

If the lighting lines cover practically all of the territory, I judge that at least fifteen solicitors would be necessary. If the competition is very keen, twenty solicitors would not be excessive.

Wm. Rawson Collier
Atlanta, Ga.

This city has a population of 250,000 which covers an area of fifty-eight square miles. We are in competition with natural gas which sells at 25 cents per thousand cubic feet. We are handling the situation in this city with eleven men. The town is divided into eleven districts, and a solicitor assigned to each district.

C. F. Farley, Manager Lighting Contract Dept.
Kansas City Electric Light Company
Kansas City, Mo.

22—81. What is a fair yearly charge per 16-candle-power lamp for suburban street lighting, the service to be multiple, 118-volt; to include all construction work, lamps, an all-night service, and controlled by a time switch. The company's lines serve the district with residence lighting.

(See December BULLETIN for other answers.)

With the advent of series tungsten street lamps we have considered the carbon lamp obsolete for suburban street lighting.

We have standardized the 5.5 ampere, 50-watt, 40-candle-power series tungsten street lamp and charge $25 per year for this service, lamps burning from dark to 1 a. m. on the Philadelphia moonlight schedule.

We charge $30 per lamp per year for all-night service on the Philadelphia moonlight schedule.

It is not practicable to use a time switch.

Foregoing prices include all construction, lamps and maintenance —contracts made for a period of ten years.

We have replaced carbon lamp systems with the series tungsten lamp system in a number of suburban towns and the results are very flattering.

At present we are lighting about eighteen villages and towns with the series tungsten lamps.

John G. Learned
Chicago, Ill.

22—88. Is there any company having in operation a flat-rate window-lighting agreement? If so, what is it and how does it work out?

(See November and December BULLETIN for other answers.)

The remarkable growth of window lighting in Denver has been the result of a flat-rate window lighting agreement which provides for the operation of the window lights from dusk to midnight every night in the year. It has worked out very satisfactorily, meeting with the approval of the merchants and causing them to be boosters for display lighting.

Ross B. Mateer
Denver, Col.

Flat-rate window lighting is exceptionally good and satisfactory business. Primarily it is the best mutual, company and consumer advertisement obtainable. Flat-rate window lighting is the opening wedge in securing both interior and sign lighting of stores. We make a flat rate of 25 cents per 60-watt tungsten lamp to burn from dark to 10 P. M., 6 days per week and dark to 12 P. M. Saturday. Switch is provided on outside of building in accessible place; lights are turned on and off by company patrolmen, except in outlying districts, where time switch is used.

John G. Learned
Chicago, Ill.

This company has in operation a flat-rate window schedule. Our windows operate from dusk to midnight and bring in a revenue of $1.25 per 100-watt tungsten. We do not furnish free renewals, however. We have patrolman to turn each window on and off. This system works perfectly and is a very satisfactory basis upon which to secure window lighting.

J. E. Harsh
Joplin, Mo.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given?

Are there any member companies giving off-peak rates or lower rates for cooking?

(See December BULLETIN for other answers.)

All single phase motors and rectifiers such as are used in residence sections are installed on the 220-volt single-phase circuits, being the two outside wires of our three-wire lighting service. All power business on such circuits is subject to off-peak schedule. Charge is made on regular rates.

Ross B. Mateer
Denver, Col.

The Hartford Electric Company made two contracts recently giving a special price for refrigeration off peak, the customer agreeing to shut down during certain hours during the peak load, the company having the privilege of installing a clock switch to cut off the service during peak hours. This refrigerating apparatus is automatic, and auto-

matically starts up when the switch closes the circuit. A graphic meter can be installed to indicate the period that the current is shut off.

The Hartford Electric Light Company makes a special low price for cooking regardless of peak.

R. W. Rollins, General Manager
The Hartford Electric Light Co.
Hartford, Conn.

This company makes off-peak rates. Its regular standard rate consists of an annual demand charge of $42 per kilowatt for first ten kilowatts, $30 for next 50 kilowatts, and $24 for each kilowatt in excess of 60; plus an energy charge ranging from 1 cent to 5 cents per kilowatt hour.

The foregoing rates, less one-half the demand charge, apply to all customers contracting to utilize and utilizing the company's service at times during the day, other than during the hours of the months specified as follows:

Month	Hours During Which Service Shall Not be Used
October	5:30 P. M. to 7 P. M.
November	5:00 P. M. to 7 P. M.
December	4:30 P. M. to 7 P. M.
January	4:40 P. M. to 7 P. M.
February	5:20 P. M. to 7 P. M.
March	6:00 P. M. to 7 P. M.

The regular rates, less three-quarters of the demand charge, apply to all customers contracting to utilize and utilizing the company's service only during the hours 10 P. M. to the following 7 A. M.

The use of the service under these rates is controlled by the following clause in the contract:

> "Consumer shall take said power only as above stated, and shall not sell or otherwise dispose of said power to any other party. Consumer shall install and maintain in operating condition an approved automatic time-switch.
>
> "The maximum demand of .... kilowatts to be available continuously for Consumer's use, shall be limited by the operation of an approved automatic overload switch or circuit breaker installed by the Consumer and subject to the control of the Company."

These off-peak rates are applicable for all classes of service and would be applicable to the use of the service for cooking, but, of course, it would not be possible to take advantage of them.

This company does not have a special rate for cooking, but under its rate schedule, the energy charge for cooking is 5 cents per kilowatt hour.

C. N. Duffy, General Sales Agent
The Milwaukee Electric Railway and Light Co.
Milwaukee, Wis.

This company gives no off-peak rates, but we have one consumer on a lower rate for cooking purposes. We made a contract based on a yearly consumption. Under this rate he pays us a fixed amount each month, no matter what the consumption, and the balance is adjusted yearly. We figure that the low consumption in the summer lighting is just about offset by the increase in the winter, and that the cooking rate will remain fairly constant, so we use but the one meter.

R. A. Brooks, Secretary
Bristol Gas and Electric Company
Bristol, Tenn., Va.

This company furnishes current to customers with installed capacity in motors of 50 horse-power and upwards at the very low rate of one cent per kilowatt-hour, providing they agree to shut down their entire plant from 5 P.M. to 6:10 P.M. from October 1 to March 1 each year; if they do not care to do this, there is a 25 per cent increase in the price. This rate is given to all classes of power consumers, and while we have no special means of controlling this supply, we have had no trouble in having our customers live up to the terms of this contract.

We are not giving off-peak rates or lower rates for cooking.

Thomas F. Kelly, Contract Agent
The Hamilton Electric Light and Power Co., Ltd.
Hamilton, Canada

22—41. I have recently built an electric oven with heavily insulated walls to take advantage of the fireless-cooker principle, and fitted it with an automatic temperature-controlling device which seems to stand up and be sufficiently simple to be handled by the average person of the sort into whose hands such an oven would fall in domestic use.

So far as tests now being made indicate, the economy of operation is going to compare very well with that of a gas oven, with the advantage of having the automatic control, this with electricity at even 10 cents per kilowatt-hour.

Can you supply information as to the rates made for current for uses of this kind by the various electric companies? Are special rates made for current thus used? If not, what would be the rates charged in small and large cities?

Our standard billing system is a two-rate one, 12½ and 5 cents. The high rate is charged for 30 hours' use a month of a certain percentage of the lamps connected in a residence. All current in excess is billed at 5 cents. By not considering heating apparatus in determining the number of units to be billed at the high rate, this apparatus automatically gets the benefit of the 5-cent rate.

H. L. Wallau
Cleveland, Ohio

[A well-known manufacturer of heating and cooking appliances, whose product is sold all over the United States, when approached for information on this subject, said: "In many of the large cities no special rate is made for cooking. In the smaller cities it is quite frequent. In a few cases rates rule as low as two and three cents per kilowatt hour, but rates for domestic cooking varying from three to five cents are quite numerous. Many of the large cities now sell current for lighting at 10 cents, which would also apply to cooking, and a number of them give discounts, bringing the rate below this figure. This is about as definite a statement as could be made in answer to this question."—Editor.]

23—18. What percentage of the total number of customers connected, are disconnected, annually, for non-payment, in companies which have 10,000 customers or more?

Six-tenths of 1 per cent of our consumers are disconnected annually on account of non-payment.

Joseph D. Israel
Philadelphia, Pa.

Five and one-half per cent of the total number of services discontinued throughout the year.

S. M. Sheridan, Sales Manager
The Edison Illuminating Co.
Detroit, Mich.

Seven-tenths of 1 per cent.

Theo. Clauss, Secretary
The Union Gas and Electric Co.
Cincinnati, Ohio

In our experience we have found that the number of customers disconnected annually amounts to about one-fifth of 1 per cent.

W. T. Nolan
Rochester Railway and Light Co.
Rochester, N. Y.

Approximately 1 per cent.

John G. Learned, General Contract Agent
North Shore Electric Co.
Chicago, Ill.

The total number of consumers disconnected during the year 1910 for non-payment of bills is 284, or about one and one-tenth per cent; however 25 of these were re-connected upon the payment of their account. We have a total of 25,000 consumers.

William A. Donkin, General Contracting Agent
The Allegheny County Light Co.
Pittsburgh, Pa.

In Hamilton with a population, according to the assessment department, of 73,538 inhabitants, we have something like 6118 lighting customers and our records show that during the year 1910 we had to disconnect 134 of these customers for non-payment, which would mean that 2 per cent of our total number of customers are disconnected annually for non-payment. It is interesting to note here, however, that our records show that the total number of houses connected to our lines which have been disconnected for non-payment from time to time is less on January 1, 1911, than on January 1, 1910, which goes to show that a large number of the customers which have been disconnected for non-payment have been re-connected, or that a number of such customers have vacated the premises and the new tenants moving in have contracted and are using electric service.

Thomas F. Kelly, Contract Agent
The Hamilton Electric Light and Power Co.
Hamilton, Canada

The percentage of customers disconnected annually for non-payment will not exceed in this company's practice 3 per cent.

J. A. Van Duyne
New York Edison Co.

With approximately 7000 customers connected, our annual disconnections for non-payment amount to approximately 450.

T. S. Mitchell, Jr.
Atlanta, Ga.

1.35 per cent.

E. E. Wheler
Toronto, Canada

22—19. What percentage of the total number of contracts with new customers, in companies having 10,000 or more customers, are accepted without a guarantee deposit?

Ninety-eight per cent of the total number of contracts with new consumers are accepted without guarantee deposits.

Jos. D. Israel
Philadelphia, Pa.

Approximately 70 per cent of new contracts secured are taken without a guarantee.

S. M. Sheridan
Detroit, Mich.

Ninety-seven per cent.

Theo. Clauss
Cincinnati, Ohio

About 95 per cent of our customers are accepted without a guarantee deposit.

W. T. Nolan
Rochester Railway and Light Co.
Rochester, N. Y.

The percentage of the total number of contracts with new customers accepted without a guarantee deposit will run approximately 90 per cent.

William A. Donkin, General Contracting Agent
The Allegheny County Light Company
Pittsburgh, Pa.

From 75 per cent to 80 per cent of new applications accepted by us are taken without guarantee deposits.

J. A. Van Duyne
New York Edison Co.

Approximately 60 per cent of our contracts are accepted without a guarantee deposit.

T. S. Mitchell, Jr.
Atlanta, Ga.

95.8 per cent.

E. E. Wheler
Toronto, Canada

23—20. In power plants from 100-kilowatt to 1000-kilowatt capacities where there have been both a modern steam plant and a gas producer plant, how do the total costs per kilowatt generated compare?

The load factor and cost of fuel must always be kept in mind in drawing a comparison between the ultimate cost of power produced by steam and gas. The ratio of cost of gas *vs.* steam power, varies with the size of the plant, as the gas engine remains practically constant over the entire range of sizes while the steam plant steadily improves as the capacity is increased. Although this statement applies mainly to the fuel factor, it is in a measure true also of labor and fixed charges. Some idea of the effect of load factor and fuel prices upon the final power cost, may be obtained from an abstract on Gas Power in the January issue (1911) of the Electric Journal. The author here intentionally favored the gas engine in making the comparison on the basis of their normal ratings, the guiding premises being that other equipment already installed would carry any peaks sustained by the station, and also in equating the percentage of investment charges, which is at present open to debate.

Edwin D. Dreyfus, Commercial Engineer
The Westinghouse Machine Company
East Pittsburgh, Pa.

23—21. Wanted: Information or recent data relative to the cost on which electric companies base their minimum charges. That is, figures giving general information as to the stand-by or investment cost per kilowatt along the lines of, say, one hundred dollars per kilowatt for station equipment, and then certain figures for overhead line construction, and certain other figures for underground construction per kilowatt capacity, etc.

For lighting service in an ordinary town of 100,000 inhabitants or less, the cost of the distribution only will vary from an average of $125 per kilowatt in the case of the one kilowatt customer, to possibly an average of $30 per kilowatt for the five hundred kilowatt customer. In some cases the cost of the distribution system for the small, scattered customers may be as high as $300 per kilowatt. For wholesale power the cost of the distribution system will vary from $20 to $60 per kilowatt. Forty dollars to $60 per K. V. A. is probably an average figure for underground power service where the underground system is only used in the business centre.

In the case of wholesale power customers, the minimum charge is generally based upon at least 12 per cent of the total net investment that must be dedicated to the use of any particular customer; this to cover ordinary interest, depreciation, taxes and insurance. The minimum charge should be at least as much as this, and theoretically enough more to cover the administrative expenses, attendance, etc. Practical competitive conditions often make it necessary for the central station to assume some business chance, and look to the income resulting from the kilowatt hour charge to cover all items in excess of the 12 per cent.

Owing to the effect of diversity factor, which effect is most complete in the larger systems, the actual generating capacity required to serve such a customer, aside from relays, etc., may not be the customer's yearly maximum demand, but rather some lesser figure, varying more or less according to the diversity factor of the particular system. In other words, the demand upon the station is not the sum of the customers' maxima, but rather a figure more or less approaching the sum of the customers' average demands.

The cost of distribution system alone for a small customer may be in some cases as high as $200 or often $300 per kilowatt against possibly $20 to $40 per kilowatt of capacity for wholesale power service. Manifestly the minimum should be proportional to the electric capacity of the distributing system and generating capacity required by the customer.

In the case of loads with less than unity power factor, it is obvious that this condition is best met by defining the capacity in K. V. A. rather than kilowatts of energy. Poor load factor, twenty-four hour core losses resulting from the use of small sized transformers, etc., may in some cases of small power and lighting customers make it impossible to deliver at the service side of the customer's meter more than 50 per cent of the power delivered to the generating switchboard.

In the case of wholesale power customers, the total losses may not be more than 10 or 12 per cent. As a large part of these losses, especially for the small consumer, are in the nature of fixed charges resulting from twenty-four-hour core losses, etc., often allowance is made in the minimum charge to care for this feature

Where supply is derived from water-power, which cannot be stored, the minimum charge often resolves itself into the equivalent of a flat horse-power year rate, this, because the water cannot be stored and used later.

In Massachusetts, for lighting service the recent rulings of the State Commission have been such as to encourage a flat kilowatt hour charge with a nominal minimum not much more than covering care and maintenance on meters, services, etc.

N. T. Wilcox
Lowell, Mass.

24—31. Inquirer would like information from companies as to whether they attempt the right to cut off for an appliance debt. That is, if purchaser of cooking or heating appliance refuses to pay for same, do you disconnect, same as you would for a current debt?

(See November BULLETIN for other answers.)

With this company we disconnect service for non-payment of appliance debts the same as for current debts.

J. E. Harsh
Joplin, Mo.

Under the terms of our contract we (North Shore Electric Co.) have the right to cut off the service for non-payment of any debt of the customer. We never have had occasion to exercise this right. As a matter of policy, it is preferable to take back the appliance, which probably would be in good condition as the account ordinarily would not be over 60 days standing.

John G. Learned
Chicago, Ill.

24—34. Do member companies furnish memorandum meters free of charge or is a rental charged for each meter, and if so, how much, where current is furnished to the owner or lessee of a large building who resells the service to the various tenants, such as office buildings, etc.?

Our practice is to sell meters outright to customers desiring to resell current. We install and test these meters for the owners at cost price, but they do their own reading and billing.

H. B. Williams
Chicago Heights, Ill.

This company does not furnish consumers with memorandum meters free. We do however, sell such meters to consumers, and if desired by the latter, maintain and read them at monthly charge of fifty cents each.

Frank Yatteau
Rochester, N. Y.

For temporary service, not more than three months, we (North Shore Electric Co.) furnish memorandum, or check, meters without charge. If the customer wishes them permanently, they are furnished at his expense. I recall one power customer who has eight meters in

as many departments in a large factory. Only one meter is furnished to an installation by the company. It is not good policy to sell current for resale.

John G. Learned
Chicago, Ill.

It is the practice of this company in selling current to the owner or lessee of a large building, to sell him current strictly for his own use, that is, for the lighting of his own apartments and halls, etc. This permits us to deal independently with the consumer, and they pay our regular rates. We have some power customers who have meters installed simply for their own information as to the consumption of their different shops, and to these customers we supply the meter and maintain same, charging a yearly rental amounting to about twenty per cent of our investment.

Thomas F. Kelly, Contract Agent
The Hamilton Electric Light and Power Co., Ltd.
Hamilton, Canada

24—25. How many credit men does it require to handle the total business of a company with 10,000 or more customers, and what is the method of passing on this credit?

The practice of the Philadelphia Electric Company in re-credits and collections is explained by the attached quotations from paper presented by the writer at a recent electrical convention.

"A great deal of attention is given by many companies to the matter of cash deposits from consumers to guarantee the settlement of bills for electric service.

"Considering the collection system in vogue with most of the companies and the terms of contracts which call for prompt payments or the discontinuance of service, it would appear that perhaps more time and money are spent upon the consideration of credits than is warranted by past experience.

"There are many companies which devote quite a large amount of the time of certain of their departments to the investigation of credits, and many others, who, in turn, insist upon deposits in what appears to be too many cases.

"The Philadelphia Electric Company, as a general rule, does not require consumers to make a deposit when meters are installed.

"The solicitor must keep the district manager advised when the responsibility of the consumer or the nature of the business, or the general appearance of the surroundings, would indicate the case to be a doubtful financial risk.

"In cases where the consumer is considered a great risk or the amount of money involved is apt to run into a large sum, a deposit is secured and the contract calls for weekly or bi-weekly payments on presentation of bill.

"Interest is paid on deposits at the rate of three per cent per annum.

There are certain classes of business of which it is the rule to

secure a deposit, for example: Moving picture parlors, etc., deposit and weekly bills; parties occupying premises temporarily for special demonstrations, deposit and weekly bills; parties who gave previous financial trouble, deposit and bi-weekly bills."

Joseph D. Israel
Philadelphia, Pa.

The initial credit of customers is passed on by the Sales Department and security demanded, if it is deemed necessary. Subsequent credit and the collection of past-due bills is taken care of by the Collection Department. The Collection Department consists of a chief clerk and six assistant clerks.

S. M. Sheridan
Detroit, Mich.

One man. We follow the usual method of passing on credits.

Theo. Clauss
Cincinnati, Ohio

Regarding the number of credit men we require to handle the total business of our company, would state that the credit of our customers is passed upon by the treasury department and myself, and in case there is any doubt in our minds as to the credit of a prospective customer, we have him looked up by a commercial agency.

William A. Donkin, General Contracting Agent
The Allegheny County Light Company
Pittsburgh, Pa.

The credit staff of this company is under the general supervision of the auditor, and is composed of the chief and assistant chief of the collection bureau and three chief clerks. The territory is divided into three districts, a chief clerk in immediate charge of each. The credits are determined in each district by the chief clerk, in ordinary cases when new business is submitted by the contract department, the general rule being to require deposits; but this rule may be waived on the determination of the applicant's standing through the medium of R. G. Dun & Company's Commercial Agency, The Retail Dealers Protective Association, and the usual trade channels.

In addition the branch offices each have a clerk in charge (of collections) reporting directly to the chief of the collection bureau, who receives payment of bills and is qualified to pass upon credits to the extent of accepting deposits on applications submitted there, as well as to put through applications whose status may be determined from previous accounts, etc., in other words, routine matters within certain defined limits.

The collections of bills is under the supervision of the chief clerks also, including the disconnection of service for non-payment, subject to the stated policy of the company. Questions of variations from the ordinary routine either as to credits or the collection of the accounts are referred to the chief of the bureau (or the assistant chief), close communication being maintained between the chief clerks and the bureau heads.

The system is more extensively described in a paper prepared by the writer, and read before the Accounting Section, at the convention in St. Louis last May, entitled, "The Workings of a Collection Bureau."

J. A. Van Duyne
New York Edison Co.

We have one man that looks after the credits and collections from the office end.

H. J. Gille
Minneapolis, Minn.

With 7000 customers we use two credit men. In passing on credits, we use a local Credit Book and Bradstreets. As a general rule, deposits are not asked of property owners.

F. S. Mitchell, Jr.
Atlanta, Ga.

24—36. What is the best policy for central stations as regards the renewing of tungsten lamps, also at what price should they be sold? By this we mean, whether they are to be sold at list prices, net prices, or should they be replaced free when burned out. This should apply to stations of our size. Our city has a population of about 28,000 with a station capacity of 1500 kilowatts. Our present practise is to have all meter customers purchase their first installation of carbon lamps at $2.50 per dozen. After that, we renew the carbon filament lamps free when they are returned burned out, to our office. Tantalum lamps and Gem lamps we renew for 25 cents less than the list prices. Tungsten lamps we do not renew at all, but sell them at list prices. Also would it be better to raise our rates one or two cents per kilowatt-hour and then furnish free tungsten lamp renewals. Our rates for residence lighting average from 12 cents to 7½ cents net.

(See December BULLETIN for other answers.)

The first installation of carbon filament lamps is charged to the consumer and all burn-outs are renewed free of charge. Tungsten lamps are sold at list price and are not renewable. Cities of 28,000 population will find it to their advantage to follow the same rules.

Ross B. Mateer
Denver, Col.

This company furnishes no free renewals of tungsten lamps. We sell lamps however at less than list price just allowing ourselves sufficient margin to cover breakage and cost to handle. We sell carbon lamps at practically cost but do not renew them. We consider this plan a satisfactory method of handling the lamp situation.

J. E. Harsh
Joplin, Mo.

We (North Shore Electric Co.) furnish the original installation of standard carbon filament lamps and renewals free of charge. We make an allowance of twenty cents each on exchange of special lamps, such as tungsten, round, Gem lamps, etc., provided the old lamp is returned intact. A 60-watt tungsten retails for ninety cents, renewal price with burned out lamp seventy cents.

If the customer pays for renewals, at standard prices without credit for burned out lamps, we make him an allowance of one-half cent per K. W. H. on each monthly bill.

John G. Learned
Chicago, Ill.

The writer's observation of a large number of central stations in different parts of the country leads me to the conclusion that the policy of free renewals which was formerly a necessity under the then existing conditions, is rapidly growing to be an undesirable solution of the problem. With the introduction of the higher efficiency lamps of the tungsten filament type, which are carefully standardized, there is no longer the same necessity for the central station company to supervise the lamps which are placed on their circuits. When lamps are sold at less than standard rates, the central station itself makes practically no money on the sale of the lamp, whereas it might be very readily a source of income, and at the same time assisting a considerable number of electrical contractors and dealers in the city, whereas if proper co-operation should take place, such dealers and contractors would be one of the most potent factors in the spread of the use of electrical energy. Moreover, a customer seldom appreciates a slightly lower price for lamps, whereas he would appreciate an advance in his kilowatt hour rate. There is at the present time a very rapid extension in the policy of central stations throughout the country that it is not in general desirable to cut prices on apparatus which goes on their circuits, but rather to get the full rates for such apparatus, including lamps, and at the same time get the active co-operation of the electrical trade in their city. In practically every case which the writer knows of where this change has taken place, it has been successful.

V. R. Lansingh, General Manager
Holophane Co.
New York

24—37. A small central station in Iowa, in town of 2500 people, finds it necessary to install a new 100 to 150-kilowatt direct-current, 3-wire, 110-volt generator; also boiler and engine, or an alternative.

We have read and heard a good deal about gas producers and oil engines. Would it be more economical to install either a gas producer or an oil engine? If so, which?

A study of the report of the Gas Engine Committee in the 1908-1910 N. E. L. A. Convention proceedings, also of the supplemental con-

fidential report in the hands of the Executive Secretary, will shed some light on the question. The installation costs of the three types of power is approximately as follows, for 100-kilowatt units:

Steam, $55 per kilowatt, installed.
Gas or oil, $90 per kilowatt, installed.

The operating expenses are dependent on so many variable conditions, such as price and grade of coal and oil available, price of water, load factor of station, and temperament or experience of the operating engineers, that it would not be wise, from the information supplied, to state which form of power will be the more economical, even if reliability of service is not considered.

C. A. Graves, Power Engineer
Brooklyn, N. Y.

24—39. Has any member company with a good portion of its lights on flat-rates had any experience with trying to operate a day load without changing the customers over to meters?

We have from time to time purchased plants in small towns, which were operated at night only, and customers served on a flat rate basis. Our practise is to install a meter and notify the customer that on and after a certain date service will be rendered on a meter basis, giving the customer full details of rates for service. After this is done, day service is given. As a rule there are a few complaints the first few months.

John G. Learned
Chicago, Ill.

24—41. Wanted: Data regarding the results of ice-making as a side line by electric light and power companies in the United States. It has been advocated as a good means of utilizing power during the hours of daylight, and this is very important to companies using water power.

In order to throw some light on the use of off-peak power for ice manufacture, I give below an analysis of the costs of production. I have assumed that in one case the ice-plant is operated at unity load factor; and that in the other case, in order to accommodate the peak conditions of the central station, the operating time of the ice plant is reduced 25 per cent. Furthermore, I have assumed that the total profit of the enterprise is to remain the same; that the cost of management is the same in both cases; while the labor cost remains the same per ton output. The first column gives the cost per ton of ice produced when plant is running continuously; the second column gives the cost per ton when the plant is running 75 per cent of the time.

	I	II
Fixed Cost	$.40	$.534
Labor	.15	.15
Supplies and Repairs	.05	.05
Water	.03	.03
Profit	.50	.667
Management	.25	.333
Total	$1.38	$1.764

At $50 per horse power-year the cost of power per ton is $.40, making the total cost of production with unity load factor $1.78. It appears, therefore, that if the time of production is reduced 25 per cent, the ice-making plant cannot afford to pay for power more than 1.6 cents per ton.

It is impossible to take advantage of the daily fluctuations of the load for ice-making purposes, as a rule. The seasonal fluctuations, however, can be taken advantage of with satisfactory results, but it would take a close study of local conditions to determine the most satisfactory arrangement.

I. Lundgaard
Rochester, New York

NEW QUESTIONS

0—32. We are threatened with severe gasoline lighting competition and are in immediate need of whatever publications are available and useful in fighting gasoline. Information, experience or data on the subject will be gratefully received.

0—33. In the case of companies whose employes have clubs or benefit associations, is it the custom to have associate members who are not employes of the company? What is the usual membership fee for such associate members? Is it considered a successful plan to have such members, or is the disadvantage of wiring contractors and others feeling that they must join more than the advantage from the income they give the club or association?

3—7. Given the following conditions: A noncondensing plant consisting of a 4-valve engine belted to a 150-kilowatt generator and a cross compound Corliss engine (ratio of cylinders 3½ to 1) direct connected to a 250-kilowatt generator. Company has surface wells that will furnish three or four times as much water (very hard) as is required for the boilers. The small unit has practically a full load for 24 hours per day and the large unit is loaded for about six hours per day. Would it pay to install a condenser and cooling tower to get good water for the boilers? Would the condenser and tower pay from an economy standpoint?

5—8. Has there ever been a satisfactory solution for scale in boilers in a plant running noncondensing and using very hard water? If so, what is it?

5—9. Why were the boilers in the Interborough Rapid Transit Company, New York, arranged so as to use a stoker in the rear of the boiler setting as well as one in the front? What are the advantages of this, the maximum capacity and efficiency of these boilers with a double furnace? Also if same would be recommended, and cost of maintenance, as compared with boiler setting before change.

6—3. Based on a 100-kilowatt unit, supplying a load varying from 12-kilowatts to 80-kilowatts, with 12-kilowatts for about ten hours out of twenty-four, which unit would give us the best all-day efficiency:—An A. C. condensing steam turbine unit, a direct connected single valve high speed unit noncondensing, or a medium speed four-valve noncondensing unit.

What is the efficiency of each of these units in lbs. steam per kilowatt-hour for ¾ load, for ½ load, for ¼ load, for 1/5 load, for 1/10 load?

6—4. We have a 100 and a 50 horse-power Westinghouse compound engine, separately belted to a 75 and a 40-kilowatt Westinghouse 60-cycle alternator respectively. Run dark hours till midnight; morning run 6 months in year. Maximum load—winter, 70-kilowatts; summer, 40-kilowatts; coal best Iowa steam, $2.45 in bin. Two H. T. boilers but only one outfit used at a time. To save coal what would be best change, with least expense? State probable saving. Which engine would be best, and size, Corliss slow speed, Skinner high speed or Corliss 4-valve?

8—4. (a) Has any member company had occasion to compete with crude oil engines?

(b) We would like data on the performance of oil engines from 50 horse-power to 150 horse-power.

(c) If possible, we would like information as to the cost of delivering current at switchboard, also whether this type engine will operate without an attendant.

(d) Also give data as to the performance of this engine under various loads, ¼, ½, ¾ and full load, and as to its reliability.

10—40. Could we expect good results with a two-phase generator supplying two separate single-phase circuits, one circuit No. 8 wire supplying mixed lighting and motors, the other circuit No. 6 wire supplying purely lighting, by using a buck and boost feeder regulator on one circuit only?

10—41. On account of the poor regulation of our generators and engines under motor load we are thinking of installing a modern 100-kilowatt unit. Our present efficiency in lbs. of screenings per

kilovolt-ampere at switchboard is 7.4 lbs. (Corliss engines belted to generators through medium of jackshaft.) We do not wish to expend over $5,000. What will be the best unit for us to install?

10—42. A central station of 15,000-kilowatt capacity has a ratio of motor load to lighting load of 2:3, and operates at 72-power factor. Is this fair operation, and what equipment is required to raise power factor to 88?

11—19. A 50,000-volt to 13,000-volt sub-station is so designed that 50,000-volt charging current on transformers must be broken by air-brake switch. Electrolytic arresters are maintained on 50,000-volt lines. Does this operation endanger our apparatus or 13,000-volt cable?

12—41. What system is found to be the most satisfactory in distributing alternating current at 2,300-volts for single-phase lighting? Kindly submit sketch showing arrangement of feeders, mains, sub-mains, etc.

13—14. With what success has lead-covered, steel-armored cable been used in underground construction for series street lighting systems, especially on alternating current systems?

19—45. Will some member kindly advise to what extent alternating motors are used for haulage in mining industry in place of rope or mules?

19—46. In the lumbering districts where electric power is used to drive saw mills, are alternating current motors operated from the line through transformers, or do they install rotary converters and then use direct current motors?

20—73. Will member companies please state what they find to be the most satisfactory 3-phase demand meter?

20—74. On a 3-phase, 60-cycle system it is desired to measure each month the maximum K. V. A. load (not the actual kilowatts) of a customer using induction motors. Whatever instruments are used must have a time lag of perhaps five minutes as it is not desired to measure either the starting current or any momentary peak.

What is the best means of accomplishing the object in view, and will any circumstances, not ordinarily to be foreseen, give a false reading, either too high or too low?

21—23. What has been the experience of member companies as regards paying commissions, for the sale of appliances, to other than duly appointed commercial representatives?

21—24. What effort has been made to stimulate other than regular salesmen to promote the sale of various appliances as well as of the company's product?

21—25. We would be pleased to know what success some of the member companies are having with the use of the Excess Indicator, recently placed on the market; as to its practical operation, commercial features, its ability to draw new business, and its effect on old customers. We operate in a town of about six thousand, where natural gas is very cheap and it may be possible to obtain some new business with this device, but before taking action we would like to know some experience of others with it, especially in towns of our size.

21—26. We are fighting hard to secure the business of our city to operate their water-works by electric current. Will member companies who supply current to water-works help us with data and information which might aid us in getting this business?

22—42. Our city council is beginning to agitate the matter of a reduction of electric light, heat and power rates, and we feel that we should compile a new system of rates. Our present schedule to regular consumers is as follows:

7 K. W. H. to 25 K. W. H.	15 cents per K. W. H.
25 K. W. H. to 50 K. W. H.	12.5 cents per K. W. H.
50 K. W. H. to 200 K. W. H.	10 cents per K. W. H.
200 K. W. H. and over	8 cents per K. W. H.

All large users of power already have special rates and therefore will not be considered in the making up of new rates. Our business houses for the most part close at 6:30 except Saturday evenings and our residence consumers during the past year averaged 14-kilowatt-hours per month.

Our coal costs us on an average of about $2.50 per ton in the boiler room and is a very low grade, in fact, has only about 8,000 to 9,000 B. T. U's. We do not consider present schedule equitable, but it has been in use for the past eight years, and we have been afraid to change it. We do think, however, that the maximum rate should be 15 cents for the first hour's burning with suitable reduction for succeeding hours.

Suggestions or information will be greatly appreciated, especially as to what is the judgment of members as to the most modern and equitable plan for rate-making in the ordinary town of 5,000 inhabitants.

22—43. What plan do member companies follow in charging customers for welding machines, more particularly spot welders, used in place of riveting sheet metal, taking in one instance four-kilowatts for 5 seconds. The meter does not measure the total watts. What fixed charge per month should be on such machines outside of what is charged over the meter?

22—44. When in electrical contracts the term "sunset" is used, lacking a more definite specification, is the solar or standard time supposed to obtain?

23—23. A member company is anxious to have statistics showing the percentage of bills uncollectable of the different companies. As this is a matter on which a general symposium would be of value, companies are requested to contribute information on the subject.

23—24. In companies of 10,000 customers or more, how soon after a customer pays his bill is the amount posted to his account; also, is there any period during the month in which posting payments is delayed and allowed to accumulate, when taking off the balances, etc., and, if so, what is the maximum number of days?

24—44. What has been the experience of member companies in promoting, in a systematic manner, suggestions from various employes?

24—45. What member companies have discontinued the free sign proposition? Please state reasons.

REPEATED QUESTIONS

The following recent questions have received no reply or inadequate reply. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

0—31. Can any member give the installation cost and the approximate operating expenses for a year of a private acetylene gas lighting plant for a country home requiring, say, 25 lights? How does the cost of installing and operating an electric lighting plant compare with that of an acetylene plant giving equal service?

1—9. How may the discoloration of brick walls (presumably due to mortar) be prevented or removed?

4—2. We are buying a good grade of soft coal for $3.15 a ton in our bunker. Can a saving be made by buying pea coal at $2.50 a ton; and approximately what per cent of saving, leaving out the cost of changing grates; or would it be better to use a mixture of soft, with the pea coal?

4—3. Will any member having reliable data regarding thermal efficiency of house heating devices, hot air, or steam generators, please send such data to the Question Box?

5—7. What are the relative advantages and disadvantages of hand firing and automatic stoker firing of boilers?

12—28. Will some member company which has used concrete poles tell something as to results and costs?

13—11. What cable pitches do the various companies use? What were the determining factors?

17—29. What means do member companies use to insure installation of the proper size incandescent lamps in residences; do companies when connecting meter use their own discretion as to the proper size lamps to install in cellar, hallways, etc., or is this information secured beforehand from customers, and if so, through what method?

19—41. What experience have member companies had in allowing polyphase motors to be started with resistance devices in the primary instead of the ordinary auto-transformer?

19—42. To what extent have single-phase motors been successful on elevator service?

19—44. Will member companies kindly give information relative to aligning shafting for their customers, that is, whether or not they test shafting and report to the customer the condition of the same, or do any other work on shafting?

20—69. We were greatly astonished to be informed by a large manufacturer of meters, that no other central station had ever requested them to increase the size of the registering train dials.

We feel that larger dials would greatly facilitate the reading of meters and reduce errors. If all the central-station managers, who feel as we do, will write the editor of the "Question Box," it may be possible to bring about the desired change. How many would like to see the dials larger?

20—72. What has been the experience of member companies with polyphase rotating testing standards?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

21—19. What companies send out circular letters to prospective customers? Are these letters prepared by the local advertising manager, or are special advertising agencies employed?

21—21. A new-business department would appreciate description, including blank forms, cards, advertising material, etc., of successful systems used by various member companies in their power department. (Replies received will be forwarded to the questioner.)

21—22. What companies offer special wiring inducements for outline lighting of buildings? Do consumers furnish lamps and renewals? Does company furnish man and ladders for renewing lamps?

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

22-40. What member companies, if any, give a special rate for primary motors (2200 volts), or in what way do they modify their contract for secondary motors (220 volts) in order to take care of this class of service?

23—21. Wanted: Information or recent data relative to the cost on which electric companies base their minimum charges. That is, figures giving general information as to the stand-by or investment cost per kilowatt along the lines of, say, one hundred dollars per kilowatt for station equipment, and then certain figures for overhead line construction, and certain other figures for underground construction per kilowatt capacity, etc.

23—22. What is the best method of keeping customers' accounts, by cards or loose-leaf ledger, and why?

24—41. Wanted: Data regarding the results of ice-making as a side line by electric light and power companies in the United States. It has been advocated as a good means of utilizing power during the hours of daylight, and this is very important to companies using water power.

24—42. Where company regularly inspects signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat rate outline and sign work, where competitive electric lighting companies are in same field?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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CONTENTS

OPERATING IN PARALLEL

Two great methods or principles of electrical operation have been tried out with very decisive results. These are series working and parallel working; and to-day after a quarter of a century of test, the world has settled down to the universal adoption of the parallel plan. It is significant that in the economics of organization the same idea holds good, and that as the latest approval of a sound idea, the Canadian Electrical Association has now decided, unanimously, to work in "multiple," with the National Electric Light Association. That federalism which is the basis of our own system of government and has such a splendid example in the British Empire, is now brilliantly illustrated in this development of affairs in the engineering and central station field.

We are heartily glad to welcome the Canadian Electrical Association into fellowship. The "N. E. L. A." has already so many members in the Dominion, it will simply make the family party larger to have a few more. The two Associations have an

immense opportunity for usefulness in their respective countries, and by cooperation, can be infinitely more serviceable than ever before. The area of contact, the valuable interchange of knowledge and experience, the career for ability, all become greater by the union. It is certainly a striking tribute to the high appreciation in which this Association is held that the action of our Canadian friends is altogether on their own initiative. It will assuredly be the endeavor of this Association to prove worthy of the compliment implied in the alliance thus sought for by our neighbors engaged in the same industry.

ELECTRICITY THE "MATCHLESS" LIGHT

In his annual report, the Fire Marshal of Ohio states that 538 fires (in 1910) were caused by carelessness with matches, and that 182 of them were due to children playing with matches. The total loss caused thereby was $191,543.

In the State of Minnesota, the total number of fires reported (counting only those in towns having fire departments) was 1,790. Of these, 106 were due to carelessness with matches, and 67 from children playing with matches; while only 23 were ascribed to electric wires.

The Fire Marshal of the State of Ohio contends that fully 10 per cent. of the losses in the state every year are due to the "criminal match," as he properly names it.

The above facts should be good arguments for the electric light solicitor.

CENTRAL STATION LIGHTING DATA

The Association office is sending out as usual its data blank to member companies, for municipal lighting statistics and rates for commercial lighting and power. It is asked, and hoped, that these will in every instance be filled up completely and returned promptly. Such information is constantly in demand, and is found very useful by the companies asking for it. At one time, up to five years ago, these figures were compiled and issued in bulletins; but it has been found advisable for many good reasons not to print the data for miscellaneous general circulation, but to copy such parts of it as may be required. It is the fact that few companies want all the data of the 900 other company members; they want specific information as to certain points or as to companies of their own size or serving the same kind of community.

A new feature in the blanks this year is a column for electric heating and cooking rates. The numerous inquiries received on this point by the editor of the "Question Box" show a demand of very insistent character for such information, and

the Association therefore, for the first time, now seeks to collect it, for the general good. The request is earnestly made that this column, which is printed in red, will not be overlooked; but will receive proper attention before the form is returned to headquarters for filing.

Public Policy Work of the N. E. L. A.

For some months past the Public Policy Committee of the National Electric Light Association has been studying the various problems connected with "welfare" work, and last year the Association sent Dr. W. H. Tolman abroad to secure for it the latest data as to European practice, the chief countries investigated being Germany and England. Conditions in this country have also been looked into closely. With the object of forecasting its suggestions to the membership at the next convention in New York City, the Committee held a meeting in Washington last week, and remained in continuous session throughout Friday and Saturday, February 10 and 11, at the New Willard Hotel. There were present: C. L. Edgar, chairman; W. W. Freeman, president; N. F. Brady, E. W. Burdett, H. M. Byllesby, H. L. Doherty, G. H. Harries, S. Insull, J. B. McCall, S. Scovil, W. H. Blood, Jr.; Arthur Williams, T. E. Murray, president of the Association of Edison Illuminating Companies; R. S. Hale and T. C. Martin. The committee discussed most exhaustively—and reached conclusions to be embodied in suggestions for action by member companies where such plans have not been put in force already—as to provision for accident insurance, sickness insurance, profit sharing by employes, and the payment of annuities as a recognition or reward for continuous and meritorious service.

Plans of the Hotel Committee

In preparation for the annual convention in New York City, May 29-June 2, the Hotel Committee with Mr. Frank W. Smith as chairman, has already "got busy," and is now making plans of unusual thoroughness for the care and comfort of those in attendance from outside the city. With a membership of 5,250, the Association had a gathering at St. Louis last year of 2,700. The membership, growing rapidly, is now 6,600, and it seems conservative therefore to count on an attendance of at least 3,500. The Committee is planning accordingly, and is compiling a complete list of hotels in the city where guests can be properly housed and which will be convenient in reaching the United Engineering Building, West Thirty-ninth Street, where the regular sessions will be held. This list with a map will soon be available. The Committee is, however, going further than such routine work, and will undertake to make hotel reservations for every one of the 2,500 visitors—or more—likely to require accommodations. This is a "large order," but an elaborate registration system in advance will enable every member to secure early the accommodation required, and to feel sure that he will get it when he arrives. The profuse abundance of good hotel accommodation in New York helps

greatly in such work, but Mr. Smith's committee will win the gratitude of a vast host of visitors by the careful and exhaustive provisions it is now making in their behalf.

Protection from Lightning

A very successful meeting of the Committee on Protection from Lightning was held at the office of Chairman B. E. Morrow in Albany, N. Y., on December 22. The entire day was spent in discussing the method of securing information on which to base the report for the next convention. The following members were present: Messrs. B. E. Morrow, N. J. Neall, S. D. Sprong, H. B. Gear and T. A. Kenney. The committee has since been engaged in developing the programme laid down.

Overhead Line Construction

The Overhead Line Construction Committee has been working very hard all winter under the vigorous leadership of its chairman, Mr. Farley Osgood, and on February 8 met again for one of its usual all-day sessions, which in this instance lasted from 9.30 A. M. to 10.30 P. M.

The "Crossing" specification section of the report to be made at the coming annual convention was gone over for the last time, and rearranged to meet many pertinent criticisms received as the result of sending out numerous advance copies.

Mr. George Celler, chairman of the Crossing Committee of the Telegraph Superintendents' Association, was present with three other members of his committee, which is in hearty accord with the work being done, and will be glad to recommend to its Association that it adopt these specifications.

Meantime one or two subcommittee meetings have been held covering details of this report, and drawings are now being prepared. It is hoped to have the whole report in hand for the printers by March 15.

THE CANADIAN ELECTRICAL ASSOCIATION

Official advices have been received from the Canadian Electrical Association as to the action taken by that body on January 20, when it was voted to affiliate with the National Electric Light Association. This important matter is referred to editorially in this issue, and will come before the executive committee at its next meeting. Mr. P. S. Coate is president of the Canadian Association and Mr. T. S. Young, secretary. The Association has its headquarters in Toronto, and has at present a large individual membership.

OVER 500 NEW MEMBERS

Herewith is printed a list of 515 new members, coming in since the last list was printed in the January BULLETIN. This is one of the largest batches to be reported in some time, and yet if it had not been necessary to close it up a few days before the BULLETIN comes out it would be much larger. The total membership as of February 14 was well in excess of 6,600. The present list includes 13 Class A members; 466 Class B, 4 Class C, 1 Class D; and 31 Class E. Such large and sustained growth is very encouraging.

New Members

Class A: Central Illinois Public Service Company, Mattoon, Ill.; Central Indiana Lighting Company, Alexandria, Ind.; Batesville Electric Light & Power Company, Batesville, Ind.; Dyersville Light and Water Company, Dyersville, Iowa; Hoisington Electric and Ice Company, Hoisington, Kansas; Flatbush Gas Company, Brooklyn, N. Y.; Cayadotta Generating Company, Fonda, N. Y.; Bronx Gas and Electric Company, New York City, N. Y.; East Creek Electric Light and Power Company, St. Johnsville, N. Y.; Hoosac River Electric Light and Power Company, Schaghticoke, N. Y.; Columbus Railway and Light Company, Columbus, Ohio; Mt. Vernon Electric Light Company, Mt. Vernon, Wash.; Pacific Coast Power Company, Seattle, Washington.

Class B: Pacific Light and Power Company, Los Angeles, Cal.—Ross H. Fritchey.

Southern California Edison Company, Los Angeles, Cal.—A. W. Childs.

San Francisco Gas and Electric Company, San Francisco, Cal.—H. B. Hatfield, A. R. Thompson.

Pacific Gas and Electric Company, San Francisco, Cal.—A. U. Brandt, Ralph Elsman, Richard C. Powell.

Commonwealth Edison Company, Chicago, Ill.—Fred W. Archer, William H. Arthur, Joseph A. Bird, Victor O. Brevitz, William Calow, L. R. Davis, John Fleming, Edmund Forster, S. S. Elliott, W. T. Entwistle, M. Gallagher, P. D. Gallagher, Fred Hamer, Martin F. Hanson, James Imboden, J. T. Jacobs, A. C. Jantzen, Nic. H. Johann, Alfred Johnson, William Lamb, C. Lindstrom, Richard Maher, Glenn Manzy, H. Morris, Nathan J. Moss, Sam Musinger, E. W. Nader, A. L. Newcomb, Joseph O'Hara, M. S. Oldacie, George Olsen, Carl Pederson, W. B. Petty, Charles S. Stagg, Fred J. Stewart, Rudolph Stivalich, Chris. E. Trainor, Ed. Thoma, Robert D. Turgeon, Albert J. Vogel, M. D. Walters, James W. Young, M. Sellers.

North Shore Electric Company, Chicago, Ill.—Max O. Boestrow, Joseph Gannon, A. J. Lottes, G. F. Maddox, Frank L. Marsh, C. H. Monger, Keene Richards, F. A. C. Tocque, Oscar Wingard.

Consolidated Gas and Electric Light and Power Company, Baltimore, Md.—Chester A. Kauffman, Thomson King, William H. Pindell, Jr.; Harry C. Scopinich, William H. Ulrich.

Connecticut River 'Transmission Company, Boston, Mass.—Ralph C. Jacobs, E. D. Lacey.

Edison Electric Illuminating Company of Boston, Mass.—Eric L. Johnson, Edward E. Walker.

Lynn Gas and Electric Company, Lynn, Mass.—Frank E. Chase.

Malden Electric Company, Malden, Mass.—A. Nelson Lattie.

Salem Electric Lighting Company, Salem, Mass.—Cyrus Barnes.

Eastern Michigan Edison Company, Ann Arbor, Mich.—R. W. Hemphill, Jr.; George E. Lewis.

Omaha Electric Light and Power Company, Omaha, Neb.—C. J. Theleen, L. A. Williams.

Albany Southern Railroad Company, Albany, N. Y.—Robert P. Leavitt.

Hudson River Electric Power Company, Albany, N. Y.—T. S. Grady, Jr.; Morton Havens, Jr.; H. J. Hunsicker, F. Register Meginniss.

Municipal Gas Company, Albany, N. Y.—R. C. Hallenbeck, Kenneth C. Ogden, Thomas H. Powers, Edward B. Sherlin.

Genesee Light and Power Company, Batavia, N. Y.—N. J. Neall.

Edison Electric Illuminating Company of Brooklyn, N. Y.—Richard W. Allen, William C. Allen, Jr.; C. M. Anderson, Millard P. Banks, R. M. Beach, Charles Billings, Anton Boert, Otto Bremann, Joseph Eduard Buckley, John H. Byrne, James M. Campbell, Joseph K. Carroll, James B. Clark, Roger P. Clark, P. B. Collison, W. J. Corberson, Lawrence T. Croke, Frank E. Deitrich, Edward F. Dempsey, Frank Dennis, Grover Dermody, John H. Donlan, Michael A. Dooley, William J Duran, William C. Earl, W. H. Farrier, Jos. Fernandes, John J. Ferris, John H. Gearhart, John Ginsam, Charles F. Gough, Evan Griffiths, Robert M. Grogan, Charles W. Hafstrom, Luke P. Hayden, Fred

A. Henderson, LeRoy C. Hicks, John Hogan, Matthew J. Hogan, J. M. Hyland, Anton Jaeger, Charles E. Jennie, Herbert C. Johnson, W. B. Jones, Arthur L. Kebbe, Joseph Kelly, Eduard A. Kenny, B. Kent, W. E. Keyes, J. Adam Kraemer, Fred J. Knubel, William P. Law, Alexander Leonard, E. A. Leslie, Thomas J. Lynch, Vincent J. McAuliffe, Matthew H. McCarthy, James P. McCloskey, Thomas McEnelly, Daniel McGrath, John McKendry, Thomas McNulty, Rea B. McVey, G. E. MacMannus, Charles Malcher, John Martin, William J. Matthews, Ira H. Metzger, C. H. Middaugh, Frank Jesse Mills, H. V. Mitchell, Theodore Mitchell, John J. Mooney, Jr.; James R. Mount, Frank Murphy, William H. Naldrett, George Neill, Chester F. Nelson, James B. Noonan, William A. Oldridge, John Olsen, John F. O'Rourke, Walter E. Palmer, Oscar Partridge, Lawrence V. Pearson, Garrett S. Perrine, Frank J. Phelan, E. K. Ponvert, F. A. Preston, R. Harold Preston, Charles Quinn, William F. Quinn, George Rainforth, William K. Remsen, W. P. Robinson, Christian Schuerholz, Ferdinand Schuster, William Shaddock, John J. Shea, Joseph B. Siggin, Charles W. Smith, Arthur G. Solbrig, Harry C. Stevens, Robert M. Stevenson, F. Eduard Strom, Ernest Struhs, George C. Sutcliffe, Harry Sutton, Axel R. Swenson, William Tait, John Tobin, C. W. Vail, John J. Watts, Charles F. Walsh, John A. Walsh, Charles Westall, John J. White, Thomas C. Whitney, William H. Willis, Jr., Jesse C. Wright.

Edison Electric Illuminating Company of Brooklyn, N. Y.—Second list. —A. M. R. Adair, Frank P. Balcom, Wendel Baldwin, William Behling, Henry J. Both, H. S. Brown, Thomas C. Burns, Allen P. Chichester, E. J. Currey, Walter H. Daly, Robert J. M. Donald, Michael O. Donnell, George H. Drasser, Frank E. Driscoll, Edward C. Halligen, George F. Hodem, Jr.; Edward A. Holmberg, O. E. Huebner, William A. Isdell, E. H. Johnson, Frank O. Johnson, Frank T. Kealy, James H. Knapp, Jr.; Henry von der Lieth, Clarence Lindemann, John McDonald, James McNevin, Harry C. Mann, A. Mints, Jr.; William Neilan, John J. O'Hara, Martin Phelan, James Quinn, A. Rafford, E. A. Rogers, Joseph A. Rooney, E. Schaible, Carl W. Schmidt, Paul A. Schmuck, Frank V. Schoepp, E. K. Sherman, C. C. Spaulding, Walter M. S. Sutton, Charles Van Varick, John G. Weldon, George L. Wiegand, Louis Zinser.

Kingston Gas and Electric Company, Kingston, N. Y.—F. N. Bridge.

New York and Queens Electric Light and Power Company, Long Island City, N. Y.—John H. Ahrens, C. C. Arnold, W. L. Arnstein, William Bakke, J. Bisset, W. C. Blackwood, George Blauvelt, S. F. Bond, George F. Bonin, Edward Brownley, Roger M. Bultner, Stephen Burlingham, Claude J. Burrage, L. D. Christie, G. M. Davis, H. A. Deutsch, Francis X. Donovan, John J. Doyle, R. A. Drury, Harry A. Ellard, G. W. England, Herbert W. Fogal, Walter T. Frey, E. W. Gough, William Greer, Charles Hickey, Arthur R. Hilb, Charles H. Kendrick, J. Kirkpatrick, J. H. Lang, John E. McCabe, Edward J. Marshall, George Marterer, William Marterer, Gilbert P. Medero, Walter W. Miller, J. R. Malone, James M. Murtha, E. F. Prantner, P. R. Preisler, Jesse Richards, F. J. Rooney, Ferdinand C. Roth, John Schroeder, Ben F. Shaffer, S. George Slavin, Russell M. Smyth, H. L. Snyder, W. P. Strickland, W. G. Taylor, Charles G. M. Thomas, Cornelius A. Towe, W. Nelson Valk, A. T. Witherell.

Westchester Lighting Company, Mount Vernon, N. Y.—Lee B. Allen, Andrew M. Anderson, Henry Baldwin, Otto Bauman, John Bergman, William L. Bruce, C. F. Bryant, Henry M. Brundage, Charles W. Chidgey, Clarence A. Cutler, Joseph R. Donnath, Clifford A. Dassler, Charles G. Duffy, Charles Eggers, W. E. Feller, B. Gaddis, N. P. Hanson, Henry Heidel, Raymond G. Hyer, LeRoy Jenkins, Warren D. Jones, Frederick M. Klenen, Charles Larsen, Harvey B. Leach, T. W. Leviness, Lawrence T. Lynch, Harold MacCallum, Herbert D. Macfarland, M. H. Manning, W. E. Merrow, Albert W. Monroe, Jr.; R. J. Myers, C. W. Nickerson, Harold L. Packman, R. H. Palmer, William J. Paskett, Jr.; R. S. Pruyn, W. P. Risler, George Schutt, Allen A. Searle, Warren L. Secord, M.

W. Singley A. L. Spears, L. V. Snyder, S. C. Tarrant, Harold W. Watt.

Cities Service Company, New York City, N. Y.—Fred L. Lucas.

Woonsocket Electric Machine and Power Company, Woonsocket, R. I.—Joseph Pratt.

New York Edison Company, New York City.—W. H. Backer, R. LeRoy Robinson, William E. Soule, J. A. Taggart, William J. Thetford.

United Electric Light and Power Company, New York City, N. Y.—Cecil L. Adams, Fred Honvinen, J. R. Hunter, Louis C. Nautre, Peter Schraeder, Drake V. Smith, W. B. Stoughton, C. D. Winslow.

Northern Westchester Lighting Company, Ossining, N. Y.—Louis I. Bates, O. G. Bennett, R. W. Farr, Jr.; H. Warren Terry, Jr.; Stuart Wilder.

Peekskill Lighting and Railroad Company, Peekskill, N. Y.—Isaac M. Beatty, Charles LeClair, H. D. Swain.

Poughkeepsie Light, Heat and Power Company, Poughkeepsie, N. Y.—Jacob Fried.

The Philadelphia Electric Company, Philadelphia, Penn.—Frank T. Adams, William M. Beatty, Jr.; William D. Bradford, Joseph Brennan, Thomas A. Brennan, Jesse Bryan, Thomas Buck, James J. Buckley, Joseph E. Burk, Edward Carre, Robert H. Childs, James J. Clifford, Edward J. Coburn, Percival Collins, Jr.; Joseph F. Crandley, R. T. Crane, David Cronin, Alexander Crow, 3rd; William E. Danberry, Frank D. Day, Robert S. Delp, William H. Dick, George Diemer, J. R. Donley, S. W. Donley, Jno. J. Doyle, Jr., John M. Dunlap, John R. Dye, George W. Eames, Thomas G. Evans, Harold Farmary, Henry J. Forsythe, Jos. L. Fowler, Harry B. Freeman, Wm. H. Friedrick, George S. Gengenbach, J. A. Greenwood, J. H. Hackett, Morgan W. Harrison, Charles C. Holton, Charles A. Horn, J. R. Horner, Edward H. Huber, Rudolph Hutt, H. Kitchener, Jay Kline, Charles E. Knight, Eugene Kraus, Phillip Krause, Ervin Earl Kurfess, Charles A. Lane, James R. McCausland, J. Stuart McConaghy, Samuel C. McFall, Joseph P. McHugh, L. C. Macardle, C. Rideway Marter, J. W. Matthews, E. Maxwell, John A. Muench, Charles W. Packer, Edward S. Pelling, Frank L. Post, Robert F. Power, Bertram G. Regar, F. F. Reichner, John A. Roberts, Edward F. Schotter, William H. Shuster, William S. R. Smith, George Staiger, H. M. Stevenson, David Thomas, Jr.; Frank H. Tice, Vernal Travis, Elmer Vanderslice, Louis W. Vernon, Paul Walters, F. G. Watkins, Clarence A. Watkins, Archibald Watts, Howard G. Webb, William H. Wohnus, William Wood.

Toronto Electric Light Company, Toronto, Ontario.—C. D. Clairmont, Wilfred Slater, W. L. Wheatley, J. W. Birkett, H. B. Ohrt, Frank Ritz, Fred R. Wilkes.

Class C: Public Service Commission, Albany, N. Y.—L. F. Northshield, G. W. Polson.

Campion-McClellan Company, New York City, N. Y.

Hudson River Electric Power Company, Albany, N. Y.—Olin Jerome Ferguson.

Class D—Morris Iron Company Frederick, Md.

Class E—Pettingell-Andrews Company, Boston, Mass.—John E. Cousins, F. H. Foote, William R. Hoppen, Roger V. Pettingell.

Wagner Electric Manufacturing Company, St. Louis, Mo.—G. A. Waters.

National Electric Lamp Association, Cleveland, Ohio.—Napoleon H. Boynton.

Adams-Bagnall Electric Company, New York City, N. Y.—Ernest R. Bryant.

Cooper-Hewitt Electric Company, New York City, N. Y.—Percy H. Thomas.

General Electric Company, New York City, N. Y.—H. V. Allen, Oliver F. Brastow, T. J. Brown, H. G. Carlgren, Elmer, E. F. Creighton, Frederic Cutts, C. J. Dempsey, J. M. Hollister, B. L. Huff, Leonard Huntress, Jr.; A. W. Ives, H. A. Laycock, Harold B. Lewis, Robert Miller, Jr.; Charles T. Mosman, Jno. T. Queeny, G. H. Reid, H. W. Rogers, A. B. Seeley, Donald C. Shafer, Elmer Smith, Robert B. Tenney, Jr.; V. B. Wilburn.

NEWS OF THE SECTIONS

TAKING NOTICE

It certainly cannot escape the attention of our readers that the Question Box looms up bulkily in the present issue of the BULLETIN. There are, indeed, some 90 odd pages of it—far and away, we believe, the largest Question Box ever published in any kind of journal, for the benefit and instruction of an inquiring public. It is not proposed, by any means, to offer as much every month. About 50 or 60 pages is now the normal average, although a year ago it was around 30. But it happens that a good deal of interesting matter had been accumulating, and the energetic editor of the "Q. B." just yearned to "clean the slate" he had crowded so successfully.

We want individual members and Company Sections to "take notice" of this generous supply of live, up-to-date information, and would suggest to them that it is particularly for them that all these facts and figures are valuable. Whatever may be a Company policy, some individual has usually to carry it out, and how can he carry it out to the highest advantage of company and customer unless he knows what the latest and best practice is? Moreover, it often helps a man in one department to know what are the problems and difficulties encountered in other departments and around him, and how they are met; and the pages of the Question Box help to give him a vital general knowledge of the art that he can get in hardly any other way.

All this applies again to the Company Section, and we are glad to know that in some of our Sections the "Q. B." is a constant theme of study and discussion. The practice might well be developed. We know of some companies also where the questions are handed out for answer and where the replies thus elicited often become available for the general good through these pages. There are in short many ways in which the Question Box can be made a stimulus and of assistance in your work. Try it! Its perusal is a good method of beginning to "take notice." Get the habit of mental growth!

Activity in Toronto

The Toronto Section had a big turnout at the monthly meeting held on the 26th of January to hear an address by Mr. T. C. Martin upon the "Organization and Development of the National Electric Light Association." The address was partly historical and partly in explanation of the functions of the Association.

The latter half of the evening was given up to an excellent musical programme, supplied by the Section talent. One performer played and sang to a harp of his own construction and elicited tremendous applause.

Electricity as an Illuminant

The seventeenth regular meeting of the Utah Light and Railway Company Section was held in the company offices Wednesday, January 25, 1911, and was called to order by Chairman W. M. Scott at 8.10 P. M., with eighteen members and seven visitors present. Mr. B. Bullard presented a paper on "Electricity versus Gas as an Up-to-Date Illuminant." The subject was discussed in open meeting.

Mr. Henry Mann presented a paper on "The Accounting Department, as pertains to the Accounts for Consumers of Electrical Energy." This subject was also discussed in open meeting.

A report from the banquet committee was given by Mr. B. W. Mendenhall, chairman of the committee. It was voted that the annual banquet be held on Tuesday evening, February 21, 1911, at the Commercial Club.

Organization of the New York Section

A meeting of the New York section was held in the Edison Auditorium on January 24, when a constitution was adopted and when officers were elected as follows:

Chairman, Arthur Williams, the New York Edison Company; vice-chairman, J. F. Becker, the United Electric Light & Power Co.; treasurer, E. S. Bellows, Westchester Lighting Company; secretary—executive—Jesse Richards, New York & Queens Electric Light & Power Company; secretary—recording—F. Henderschott, the New York Edison Co. Executive Committee—F. W. Smith, United Electric Light & Power Company; H. M. Edwards, the New York Edison Company; C. G. M. Thomas, New York & Queens Electric Light & Power Co.; J. T. Cowling, Westchester Lighting Company; H. E. McGowan, Flatbush Gas Company; J. E. Phillips, Richmond Light & Railroad Company; J. M. Butler, the Bronx Gas & Electric Company; Carleton Macy, Queensborough Gas & Electric Company; Stuart Wilder, Northern Westchester Lighting Company; I. M. Beatty, Peekskill Lighting & Railroad Company; J. P. Radcliff, Jr., Yonkers Electric Light & Power Company.

The meeting also listened to an excellent paper and discussion on the subject of electric vehicles and their relation to central stations.

Rates and Motors in Baltimore

Mr. Herbert A. Wagner, vice-president of the Consolidated Gas, Electric Light and Power Company, of Baltimore, addressed the Baltimore Consolidated section at its mid-January meeting. The meeting was held at the Physical Laboratory of the Johns Hopkins University, and the room was taxed to accommodate those who desired to hear the speaker. Mr. Wagner's subject was "Rates."

At the semi-monthly meeting of the Baltimore section held January 31 at Johns Hopkins, Mr. E. St. Clair Clayton delivered an address on "Practical Motor Work." The lecture was a comprehensive presentation of the subject, and was illustrated by lantern slides showing a wide range of installations in Baltimore and cities throughout the country.

In the meantime the special course of lectures by Prof. J. B. Whitehead has been in process of delivery with great success.

Incandescent Lamps, B. C.

At a meeting of the British Columbia Electric Company Section, Vancouver, held on January 24 last, a paper entitled "The History and Efficiencies of Incandescent Lamps" was read by Mr. H. E. Grant, the vice-president of the section. Tracing the pedigree of the carbon filament lamp from its earliest days and touching lightly on the work of such great engineers and inventors as Edison, Swan and Von Welsbach, Mr. Grant drew many interesting and humorous comparisons between the days of the "lamplighter" with his flaming torch, and the dazzling brilliancy of the modern city streets as now effected merely by the closing of a switch. He also gave a great deal of new and very interesting information on the evolution of the tungsten lamp; explaining the difficulties met with in its early manufacture and how each obstacle had been steadily surmounted, until the present high efficiency lamp has been secured.

From a literary standpoint Mr. Grant's paper was a treat—as a scientific address it was better still. The vast amount of concentrated thought expended on the subject was evident to all who had the pleasure of hearing it.

Meters and Arcs Before Boston Section

Two useful and instructive papers were presented before the Boston Edison Section on January 17. One was by Mr. C. H. Ingalls on electricity meters; and the other was by Mr. J. C. Norcross on arc lamp practise. It was noted by Mr. Ingalls that in round figures every per cent loss due to meter inaccuracy is the equivalent of about 5 per cent of the total generating expense or of about 7 per cent of the total distribution expense. A gain in meter accuracy of only one per cent would, on the other hand, pay for the entire expense of maintaining a first class meter department, or pay approximately 1½ per cent of the entire expense of the company.

In his paper, Mr. Norcross stated that Boston has a total of 4,019 arc lamps on the streets, and a total in city and suburbs of 10,872 arcs for street and commercial lighting. Of these, 5,709 are series lamps and 5,163 multiple. A good description was given of the various types.

Magnifying and Metering Brooklyn

The Brooklyn Company Section held its fifth regular meeting of the season in the Johnson Building, Brooklyn, on Monday evening, February 6. There were present about 340 members. Hon. Alfred E. Steers, president of the Borough of Brooklyn, addressed the Section, taking for his subject "Brooklyn." He dwelt upon some of the big industrial and commercial enterprises now located in Brooklyn, and the advantage their activities are to the city. He told what a small place Brooklyn originally was, its growth, and its present size, and he gave also estimates by statisticians, as to what the population may be a few years from now, showing that Brooklyn will probably be the largest borough in population in Greater New York. A hearty and unanimous vote of thanks was tendered by the Section to the speaker.

Mr. William Eichert, superintendent of the meter department of

the Company, delivered a paper on the "Relation of Metering Efficiency to Revenue." He detailed the great care taken in placing, testing and maintaining meters of the Company, so that they register as accurately as possible, and he also presented figures showing that, as a matter of fact, the electric meter is the most accurate commercial measuring instrument in the world.

Mr. Eichert stated that the complaint tests made during the year developed the fact that a small percentage of the meters were inaccurate, and as evidence sustaining this fact, he submitted the following figures on Electric Meter tests made January 1 to November 15, 1910, by the Public Service Commission of the First District. Of 174 meters tested, 16 were found slow, 12 fast, and 146 correct. After Mr. Eichert finished his paper, a lively discussion ensued, in which the following members took part: Messrs. Cook, Graves, Babcock, Uckele, Harkness, Campbell, Bennett, Slater, Podeyn, Leitner, Kassebart, Seelman, Wagner, Cardo. Following the discussion Mr. Eichert summed up in a very able manner. The meeting was closed by a social hour consisting of an interesting vaudeville program, music and refreshments.

Business Problems

"Handling Customers' Complaints" and "Business Getting" were the topics discussed at the regular meeting of the Baltimore Consolidated Company Section, held February 14, 1911, in the Physical Laboratory of the Johns Hopkins University. Mr. G. H. Albrecht read the paper on complaints, and Mr. J. A. Sutton the paper on business getting. The papers aroused great interest and were discussed by Messrs. Douglass Burnett, R. F. Bonsall, J. S. Cruikshank, R. H. Tillman and others.

The Section has recently appointed a committee composed of Messrs. Wm. Schmidt, J. T. Kelly and the secretary of the Section to draft a new constitution. The constitution proposed by the committee was approved by the executive committee and adopted by the Section.

Station Design Before the Commonwealth Edison Section

A not wholly unpleasant quandary confronts the officers of the Commonwealth Edison Section, Chicago, who are asking each other "How shall we manage to seat our 775 member if they should *all* decide to attend the next meeting?" Each meeting starts a fresh wave of enthusiasm, and the resulting increase in membership boosts the attendance at the next meeting so that the officers are constantly grappling with the problem of how to provide quarters sufficiently large to accommodate the crowd. But as Chairman Smith remarked, "I couldn't ask for a more delightful predicament!"

At the meeting of February 7, which was held in Recital Hall, Auditorium Building, the hall was practically filled with an attendance of 356 members. It was at once the largest and the most successful meeting ever held by the Branch. The program included three very interesting papers and an exceptionally fine entertainment program. The papers were by Messrs. F. J. Arnold, A. G. DeClercq and C. J. Hejda, covering respectively the engineering, construction and testing depart-

ments, with special attention to station and sub-station design and construction, illustrated by lantern.

After the customary ten minutes' intermission, the meeting was again called to order, and the Chairman called upon Past Chairman J. C. Manley for a few remarks. Mr. Manley delivered an interesting address on the construction department, after which a brief discussion of the papers was had.

The following members of the N. E. L. A. Glee Club were then introduced by the Chairman, and sang "Kentucky Babe," "Proudly as the Eagle," "A Dog Fit," and "Gentle Willie," under the skillful leadership of Mr. Harold Wright: Messrs. Berry, Littman, McGovern, Robinson, Burke, Smith, Schaefer, McKenna, White, Childs, Forde, Bailey, Hafner, O'Brien, Mann, Ferguson, Fischer and Addenbrooke. The last two numbers were illustrated by means of cleverly drawn cartoons (the work of R. A. Fischer) thrown on the stereopticon screen with great dramatic effect. This was one of the entertainment committee's little surprises, and was received with wild applause. Miss Bessie Booth, "the nightingale of the Contract Department," sang "Because I Love You, Dear," and "For You, Bright Eyes," accompanied by Messrs. Bucher, Mulrooney, Eastman and McGovern, first and second violins, 'cello and piano. Mr. John W. Ferguson did a corking monologue stunt, and told several very funny stories in his own inimitable manner. The songs by the Glee Club, the solos by Miss Booth and the stories related by Mr. Ferguson were all encored with great enthusiasm, and the spontaneous appreciation of the audience was manifested in a roof-raising vote of thanks extended to all who had taken part in the evening's instruction and entertainment. It was a great night for the Section!

New England Section Plans

The officers of the New England Section announce that as a result of the general vote taken, and in view of the nearness of the annual convention in New York, May 29-June 2, a formal meeting will be held on March 17, but there will be no papers, no committee reports, and no entertainment features. A business annual meeting will be all that takes place, and the whole weight will be thrown on the Fall meeting as the Section convention of the year. A very large attendance of New England members is expected at the national convention in consequence of this arrangement, which was decided on by a three-to-one vote.

New Sections Forming

During the month steps have been taken for the formation of two new Company Sections, one by the Scranton, Pa., Electric Company, and the other by the Allegheny County Light Company of Pittsburgh. On February 9, Secretary Martin visited Scranton to give the local organizers information on the subject; and it is already planned to start off the Pittsburgh Section with a dinner on February 28. A great deal of interest is being manifested in both cities in the subject, and it is confidently expected that large and active sections will be organized, especially as there are several Class B members in both companies as a nucleus.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

GIVE AND TAKE

The "Question Box" acknowledges gratefully its indebtedness to the many busy workers in the industry who by their co-operation, freely and fully given, are making it a source of prompt, reliable, varied and valuable information to the members of this Association.

The result of such efforts as they appear in these columns certainly exhibits an interest in the general welfare and a spirit of mutual helpfulness, at once creditable to the individual and characteristic of the industry. We are all busy about our own affairs but never too busy to do our share for the common good.

Neither is the game all one of give. It is both give and take, for so wide a variety of subjects is treated from so many standpoints, that somewhere in the "Question Box," as the members are making it today, each one can surely find some item of knowledge or some idea which can be utilized in practise or mentally filed for future application.

CAN WE USE THIS SURPLUS ENERGY?

A question first appearing in the January BULLETIN asks: "What effort has been made to stimulate other than regular salesmen to promote the sale of various appliances as well as of the company's product?"

This inquiry suggests the thought as to whether a great many of the medium and large-sized companies could not use to advantage as

factors in advertising and promoting their business a much larger number of their own force of employes than is now done. In companies with from 200 to 2000 or more employes, it would seem as if there must be some way of systematically utilizing in this direction the enthusiasm, the loyalty and the willingness to be of service of hundreds of workers other than the regular sales force. There are certainly undeveloped potentialities here, and an attempt to direct the surplus energy of employes, now lost to the company, into productive and mutually remunerative channels, might prove well worth while.

Experiments have doubtless been tried or are being tried, and it would be interesting to hear of them. A reply in this issue of the Bulletin describes two plans essayed by the Brooklyn Edison Company, the first of which was abandoned, the second of which seems to be succeeding admirably.

We call attention to this subject because it seems one deserving general consideration.

DEPOSITS AND BAD DEBTS

In the January Bulletin comment was made upon the present-day tendency, apparent in many quarters, toward the elimination, so far as possible, of deposits from customers. Five companies out of eight reporting, accepted over 90 per cent of new customers without deposit, the percentage in Philadelphia being as high as 98.

The question inevitably arose as to whether the percentage of uncollectable bills increased with the decrease in deposits.

Question 23—23 covers this inquiry, which is answered in this issue by several companies. It is worthy of note that in Philadelphia, where fewer deposits are demanded than in any other large city, the percentage of uncollectable bills is also very small, being reported as ¼ of one per cent.

If any indications can be drawn from these figures, they are certainly significant of the possibility of getting along nicely without too much time and effort expended in matters concerning the credit of new customers. If experience shows that with a prompt and thorough system of collections we can dispense with the deposit save only in exceptional cases, without increasing the percentage of bad debts, then such a policy is entitled to consideration, as removing one more obstacle and source of delay and friction between a new customer and the central station company.

REMINDERS

Question 12—28, reading: "Will some member company which has used concrete poles tell us something as to results and costs?" has now been published several months, yet only one reply has been received.

There can be no doubt that a number of companies have had experience with or are experimenting with concrete poles, and contributions from these members on the subject would unquestionably possess widespread interest and value. There does not seem any sufficient reason why such experiences should be withheld. The "Question Box" will welcome further communications on this subject.

Along the same line, we note that question 21—26—in which a member company engaged in a determined attempt to secure certain business from its municipality, as a help to that end, seeks information from companies which supply current to city water works—has also received but one response.

There is no lack of helpfulness among us. Companies in a position to respond to this application are beyond doubt willing to do so. The probability is that the question has escaped observation and that calling attention to it here is all that is required to induce adequate reply.

NEW SALES METHODS

Question 19—44, as to whether companies do certain work, such as to test shafting, for their customers, indirectly suggests a modern tendency worthy of note—the increasing thoroughness and improved scientific sales methods with which many companies now go out after big power business. There comes a time in dealing with a large consumer of energy when salesmanship, for the moment at least, ceases to spell persuasion and means demonstration, when salesmanship as we commonly know it ends, and engineering begins. In other words, the prospect has himself a large investment in engines, boilers, etc., and before making any radical change, frequently involving heavy additional investment, has got to be *shown*. The members of the central station power staff then become consulting engineers on the premises—frequently with instructions to act unbiased for the best interests of the prospect. They diagram and "blue-print" his factory, indicate his engines, ascertain the power demands of every machine, every foot of shafting, every pulley and hanger, figure to a nicety with the manu-

facturer's co-operation, his total energy consumption, analyze it, show where savings can be effected, and draw up elaborate comparisons between present plant costs and costs as they would be with the central station as a source of supply. In some cases live steam necessary for heating or other purposes is accurately gauged and the station includes this supply in its final proposition. From one to five hundred dollars is frequently expended in a single investigation of this kind.

The Narragansett Lighting Company of Providence, R. I., after tabulating every feature of such an investigation, binds the report handsomely in flexible leather, with a title (including the name of the prospect factory or firm) in gold. This company reports that it has landed approximately half the business it has gone after in this way, that is, for every two big power consumers, whose plants have been investigated and reported upon, one is secured as a customer.

This is surely scientific salesmanship. Of course the work must be handled with skill and judgment—it must be in capable hands. But well planned and adequately executed, this method of operation cannot fail to be efficient in producing profitable power business, and it is certainly interesting as indicating the importance now attached to, and the advance that has been made in, central station sales methods during the last decade.

ANSWERS

O—81. Can any member give the installation cost and the approximate operating expenses for a year of a private acetylene gas lighting plant for a country home requiring, say, 25 lights? How does the cost of installing and operating an electric lighting plant compare with that of an acetylene plant giving equal service?

Cost of 25-light acetylene generator	$120.00
Cost of fixtures and piping, approximate	80.00
Total cost of 25-light plant	$200.00
Cost of operating for one year will vary according to light used, but will average about $4.00 per month....	$48.00

The average acetylene burner used is one-half foot (consuming one-half foot of acetylene per hour), and giving 25 candle-power. 100 pounds of carbide costing $3.75 (freight adds 25 cents—total $4.00) will yield an average of 500 cubic feet of acetylene.

I do not know the actual cost of installing a 25-light electric plant, but basing my experience on what small individual electric installations I have come across, would say that the acetylene installation would cost about one-half to buy and that the operating cost of the two would be about equal.

William Overing, Commercial Agent for
Suburban Electric Light and Power Company
St. Louis, Mo.

Cost of 25-light acetylene plant:—

Generator installed	$120.00	
Piping (iron pipe)	30.00	
Burners (no mantles)	5.00	
Fixtures and glassware	35.00	
Freight, drayage and incidentals	10.00	$200.00

If a comparison is made between a small acetylene and an electric plant of the same capacity, it would probably be found that acetylene is cheaper; the superior advantages, however, of electricity, such as safety, convenience, etc., as well as an economy nearly equal to that secured in large electric systems, could be obtained by installing an electric plant arranged to supply light and power to several property owners in the same vicinity, thus making it more economical to use electric light.

Sidney W. Ashe
General Electric Company
Harrison, N. J.

[Eugene W. Stapf, assistant business manager of the *Engineering Quarterly*, a publication of the Engineering Society of the University of Missouri, sends us a pamphlet issued by the engineering experiment station of this university and published by the university in March, 1910, entitled "Acetylene for Lighting Country Homes." The introduction to this booklet begins with the following paragraphs:

"The farm home may be readily equipped in these days with every modern convenience. One of the most important of these conveniences is a good lighting system. The oil lamp, with its accompanying dirt, inconvenience and danger, may be replaced, with the outlay of a few hundred dollars, by a lighting system almost equal in convenience and economy to a city lighting service.

"Private Lighting Systems are divided into three classes; Acetylene, Gasoline and Electric. This bulletin is the first of a series devoted to these systems; the others, Gasoline Lighting Systems and Small Private Electric Installations are in preparation.

"Those who are interested may make their own comparison of these systems as to relative economy, convenience and practicability, when the series has been published."

The gasoline and electric installation pamphlets are not yet completed.

In the publication at hand, which is very complete, the estimated first cost of installation for a house lighting system of approximately 30 lights is given as follows:

Piping	$47.00
Drain	9.60
Wood open work foundation for generator	1.00
Fixtures	49.12
Reflectors	12.68
Burners	6.00
50-light generator	158.00
Total cost of installation complete	$283.40

The total yearly cost of operating this equipment is given as $66.81. A cheaper equipment which eliminates the drain and about five lights, and uses cheaper fixtures and a 35 instead of a 50-light generator, could be installed according to this publication, for about $225, and the yearly cost of maintenance in this case would be $47.75.

As to the comparative cost of an electric equipment of 25 lights for a country home, let us assume the 25 lights to be 40-watt tungsten lamps. This would require a one-kilowatt outfit, the cost of which would be approximately as follows:

Gas engine	$250
Generator	100
Setting	50
Wiring	35
Fixtures and glassware	50
Total	$485

The cost to operate this plant with gasoline at 15 cents a gallon, including fixed charges and depreciation, would amount to approximately $50 per year. The operating figures, whether for gasoline or electric, cannot be given except in an approximate way, because such cost would depend in large measure upon the habits of the household in which the equipment was installed and the efficiency with which the outfit was operated.—Editor.]

0—32. We are threatened with severe gasolene lighting competition and are in immediate need of whatever publications are available and useful in fighting gasoline. Information, experience or data on the subject will be gratefully received.

Two years ago this city was invaded by some gasoline lighting people, shortly after the purchase of the Roanoke Water Power Company by this company. They did extensive advertising and made various guarantees as to the cost. They had quite a bit to say about this company, its service and rates. We managed to find a bulletin entitled, "Is Gasoline Lighting Dangerous?" which underneath a picture of a

skull and cross bones gives newspaper extracts and awful pictures of accidents which have been due to gasoline explosions. It certainly is a very impressive document. We ordered something like five hundred of these booklets and mailed them to all business houses in the city, that is without any name on the wrapper. This had the desired effect, for on calling on parties they were always confronted with this publication and were asked to explain as to whether gasoline lighting was dangerous. This made them very bitter and they denounced this company by scattering circulars broadcast, after which they picked up their samples and left for parts unknown.

These booklets can be obtained by addressing the Illuminating Publishing Company, of Cincinnati.

We might state that one installation of gasoline lamps sold by these parties caused a fire in a pool-room. Consequently, the generator and lamps were immediately thrown out and the electric service again installed.

F. T. Williams, Sales and Contract Agent
Roanoke Railway and Electric Company
Roanoke, Va.

[Some striking and valuable literature on this subject was also received from Clare N. Stannard, secretary and commercial manager of the Denver Gas and Electric Company, and from the Pacific Gas and Electric Company, and forwarded to the inquiring member company.—Editor.]

In Rochester and the outlying towns we have had no permanent difficulty from gasoline lighting competition. Where a few of these plants have been installed, the experience of the owners has failed to create any permanently good repute. The difficulties in operation, the fire hazard, the unpleasant odor, and the character of the light, as the lamps are ordinarily installed, all serve to dissatisfy those who make this experiment.

The best source of competitive satisfaction is electric units properly shaded by well-selected glassware. If the standard of electric illumination is or can be made high by the introduction of proper illuminating principles, the garish light of the bare gasoline mantles will in itself create decided dissatisfaction.

John C. Parker
Rochester, N. Y.

In Menominee, Michigan, and Marinette, Wisconsin, with a combined population of 26,000, gasoline competition has been real keen, there being in operation previous to our gasoline campaign over one hundred installations, the majority being in use by long-hour consumers, such as saloons, etc. To-day there are less than twenty, and time will take care of them.

Our method of replacing these plants was a campaign against gasoline for illuminating purposes. Our start was with strong news-

paper publicity, bringing out the bad features of gasoline illumination, such as fire risk, contamination of stock, unsanitary and offensive odor, false illumination, etc.—also dwelling on the argument that a gasoline system cheapened the appearance of a store, making the same unattractive and uninviting, and that gasoline was not safe, never was and never would be. Our solicitors, office men, electricians, etc., were all saturated with anti-gasoline during the campaign.

Occasionally we found it advisable to make an exchange proposition, allowing from $5 to $30 a plant, and oftentimes the price of the electric installation would offset the loss. Throughout the campaign we featured the 100-watt Mazda lamp and our cheap rate for current. An ad that brought splendid results was one of a half page entitled "A Brief Story of Gasoline Lighting in Marinette," giving the list of merchants who had recently replaced their gasoline plants with an up-to-date system. Some time ago we prepared data on the local gasoline situation representing 74 plants or 422 units; the average monthly cost of gasoline for the same was $269.45, or .64 2/3 per unit per month.

J. H. Peterson, Manager New Business Department
Menominee and Marinette Light and Traction Company
Menominee, Mich.

1—9. How may the discoloration of brick walls (presumably due to mortar) be prevented or removed?

The discoloration mentioned probably refers to what is known as efflorescence, and is due to chemical combination between constituents in the lime mortar and in the brick with carbon and oxygen from the air, forming sodium carbonate, magnesium sulphate, or other salts, according to the chemical properties of the clay used in making the bricks. Authorities state: "Such efflorescence is never due to the bricks alone, and seldom to the mortar alone."

To avoid this efflorescence some bricks would require being covered with paraffin or oil preservative, capable of keeping salts from exuding and of resisting the chemical attacks of the mortar. Bricks may be cleaned and efflorescence removed after a period of formation with a wash of diluted muriatic acid applied with a brush; but if results of further internal chemical action again exude to the surface. the washing must be repeated as often as found necessary or desirable.

F. A. Miller
Rochester, N. Y.

2—8. What should be the size and spacing of the rack bars for a trash rack in a water power plant? At what angle of inclination should the bars be placed, and what is the loss of head in the rack for different velocities?

We make all our trash rack bars of 3 x ¼ inches rounded edge tire steel. The spacing depends upon the size of turbines served. For small turbines, 18 to 32 inches, they should be spaced on not more than

1¼-inch centres; from 34 to 42 inches, 1¾-inch centres; 44 to 60 inches, 2-inch centres; 62 to 72 inches, 2½-inch centres. These dimensions can all be increased one-fourth of an inch if the turbines have cylinder gates. The angle of inclination should be from 30 to 40 degrees. The loss of head will depend upon the total area of the trash racks and the water passed by the turbines. The velocity should not be greater than 2 feet per second.

Lancaster Electric Light, Heat and Power Co.
Edward D. Ruth, Superintendent
Lancaster, Pa.

In my judgment so general a question should not be answered. The protection of an intake of a hydraulic plant is a matter of considerable importance to the future success of the plant, and its construction differs with the contending conditions.

Is it a running stream, or a quiet fore-bay?

What is the character of the trash against which the intake has to be protected?

What is the depth of the water? Temperature? Frazil? Anchor-ice?

This is the kind of a question which should be submitted with full information as to what is required.

W. B. Mayo, Secretary and General Manager
Niagara, Lockport & Ontario Power Co.
Buffalo, N. Y.

Bars should be about ¼ inch by 4 inches spaced 1¼ inches on centres; the angle of the inclination, 2 inches to a foot. (Velocity not known.) Allow all the space you can below the water level. A good rule would be three times the area of the penstock.

Holyoke Water Power Company
Holyoke, Mass.

The screen should be close enough in its spacing to shut out all the floating material which would be large enough to clog the nozzle or gates delivering water to the power-house wheels.

It should be sufficiently inclined for easy raking, say one vertical to two or three horizontal. It should be so placed as to be easily cleaned, and the velocity through the bars should be low enough to allow any trash to be raked readily off the screen.

The size and spacing of bars should be such that the loss in head would be less than one foot.

The screen should be strong enough to stand water pressure if entirely clogged with matted leaves, as is sometimes the case. The size of bars is, of course, dependent upon their unsupported span.

As an example of the two types of screens:

(a)—On a large river varying in flow from 1000 second feet to 100,000 second feet. the intake is through a gate tower having bar screens set vertically of ⅝ x 4-inch iron on 2-inch centres, leaving a

clear opening of 1⅝ inches. In this plant, the intake gates are always submerged and there are no secondary screens; but as the units in the power-house are 10,000 kilowatts each, the wheel openings are necessarily very large.

(b)—On a river varying in flow from 200 second feet to 15,000 second feet, the bar screens are set on an incline of 20 inches in 8 feet and consist of ½ x 3-inch bars on 3-inch centres, leaving a clear opening of 2½ inches. This plant has below its intake a sand box and at the head of its pressure main secondary screens, as the stream carries an enormous amount of leaves during the fall rise of the river.

H. H. Sinclair, Vice-President
Great Western Power Company
San Francisco, Cal.

The size and spacing of rack bars, (which are usually placed near the pen-stock, or pipe line) vary a great deal, due to the character of material floating in the water. In our winters, when a great deal of leaves and light debris are floating, it requires the frequent attendance of a man to free the rack.

The angle of inclination is usually about 30 degrees, so the velocity of the water will force the trash up on the racks, thus partially freeing itself. The head loss in the rack varies entirely with the size and shape of the bars, and the velocity of the water.

The question, therefore, is not answerable in general terms; each individual design would require a special calculation.

John A. Britton, Vice-President and General Manager
Pacific Gas and Electric Company
San Francisco, Cal.

In my opinion the size and spacing of rack bars will depend on their length (depth of water) and method of support, but they are usually made up of material 2 x ¼ inches to 3 x ⅜ inches, spaced about 1½ inches apart. The angle of inclination is usually a matter of convenience and should be about 15 degrees to 20 degrees from the perpendicular.

E. J. Richards, General Superintendent
Connecticut River Transmission Company
Fitchburg, Mass.

8—6. What member companies have installed rotary condensers on their feeders for the purpose of correcting the power-factor? What economies have been shown thereby, also what detrimental results have been demonstrated, if any? Have the advantages offset the cost of making such installations?

(Other answers in January BULLETIN.)

We have installed rotary compensators in substations for the purpose of correcting power-factor and have obtained excellent economy

thereby. This company sells power exclusively and, as is to be expected on any commercial load, the power-factor is considerably less than 100.

In two of our sub-stations, supplying power for general factory purposes, we have installed 3000 KVA vertical-shaft machines, working on our 2200-volt outgoing 'bus-bars. With these we have raised the average power-factor at each station, at the average loading, about 20 per cent. This relieves the step-down transformers, the high-tension cables leading to the substations, and, in particular the prime movers, helping their regulation.

The net result is that we have paid for the cost of these machines in a trifle over a year. We have experiencd no detrimental results with their use.

We have not installed such machines on feeders, as it has not been practical in the case of the general manufacturer, who prefers using induction motors, either for simplicity or for the condition of his work.

H. B. Alverson, Superintendent
The Cataract Power and Conduit Company
Buffalo, N. Y.

The Hartford Electric Light Company has installed on its lines at present, two 200 KVA rotary condensers. The first of these is installed about 1⅞ miles from the generating station, near the load-center, on a 2-phase, 4-wire, 2400-volt, 4/0 feeder. This feeder consists of about 1 mile of 4-conductor, 4/0 underground and the remaining ⅞-mile of 4/0 overhead construction. The condenser is installed on the low tension (230 volts) side of a bank of two 50-kilowatt transformers, operating a load of induction motors, arc lamps, etc. The rotary condenser itself is not used to furnish any power to shafts, etc., but is used merely as a condenser to correct the power-factor at this point. Where the drop of this feeder at this point sometimes reached 12 per cent previously since the rotary condenser has been installed and operated to a capacity of 500 amperes of leading current, the drop on the primary feeder has been reduced to 8 per cent. Where the primary current at normal load on this feeder used to be 180 amperes, the condenser has reduced this to 150. The power-factor on this feeder before installing this condenser, was 69.8; the condenser has raised this to 82.4. This amounts to a saving of 170 KVA. In other words, the capacity of this particular feeder has been increased this amount.

The second condenser is installed at the end of two paralleled, 4/0, 4-conductor, 2-phase, 2400 volts, underground feeders, ¾ of a mile long. The condenser is also installed on the low tension side of a bank of transformers, consisting of six 100-kilowatt units, supplying an induction motor-load in a large factory. The power-factor on this set of feeders used to be 72 per cent and the condenser has raised this to 82.6 per cent. The KVA on this feeder have been reduced to 85, thus increasing their capacity by this amount.

This company has experienced so far, perfectly satisfactory results with the above operation of these condensers, except that we find that when the load drops off on the above mentioned feeders, during the noon hour, that it is necessary to change the adjustment of the condenser so that it runs at practically no load, with the power-factor, within itself, of 100. As soon as the load comes on the feeder again, we adjust to a leading current as before.

The Hartford Electric Light Company
Frederick Welles Prince
Supt. Meter, Arc Light and Inside Const. Dept.
Hartford, Conn.

3—7. Given the following conditions: A noncondensing plant consisting of a 4-valve engine belted to a 150-kilowatt generator and a cross compound Corliss engine (ratio of cylinders 3½ to 1) direct connected to a 250-kilowatt generator. Company has surface wells that will furnish three or four times as much water (very hard) as is required for the boilers. The small unit has practically a full load for 24 hours per day and the large unit is loaded for about six hours per day. Would it pay to install a condenser and cooling tower to get good water for the boilers? Would the condenser and tower pay from an economy standpoint?

The installation of a cooling tower and surface condenser would improve the water for boiler use. The cooling tower and condenser would improve the economy of the plant from 10 to 12 per cent after allowing for the steam consumption to operate the necessary auxiliaries.

H. P. Wood
Brooklyn, N. Y.

4—2. We are buying a good grade of soft coal for $3.15 a ton in our bunker. Can a saving be made by buying pea coal at $2.50 a ton; and approximately what per cent of saving, leaving out the cost of changing grates; or would it be better to use a mixture of soft, with the pea coal?

The information given is rather insufficient for making an estimate such as is asked. If a grate is installed, which will handle the cheaper grade of coal satisfactorily, there is no question but that a saving can be effected. There are so many different factors influencing this result, however, on which we have no information, that a definite answer is not possible.

Alex D. Bailey
Chicago, Ill.

5—7. What are the relative advantages and disadvantages of hand firing and automatic stoker firing of boilers?

The advantages of hand firing over stokers are practically limited to small installations where the expense of stoker installation would

not be warranted, as there would be no resultant saving in labor, and also, in banking fires during the off-peak period, a hand-fired boiler takes much less fuel than one equipped with stokers.

The advantages of stokers over hand firing are largely in labor, as one man can operate three and sometimes four 600 horse-power stoker boilers, where the same amount of labor could handle but one boiler of similar capacity with hand firing.

The stokers will handle poorer and different grades of fuel more efficiently and with less smoke than in the case of hand firing, and also, with stokers, it is not necessary to open the furnace doors, as has to be done each time a hand-fired boiler is coaled, thus letting cold air into the furnace to the detriment of its efficiency. However, poor coal which has a tendency to form slag, cannot be used in stoker-fired grates, as such a formation prevents proper operation of the stoker mechanism.

For proper economy, stoker boilers should be in continuous service and should be used only where a very high and constant load factor on the boiler is assured.

There will be a slight increase in maintenance cost on account of stoker equipment, but under constant boiler load conditions, this is very much more than offset by the saving in labor.

—**Farley Osgood,** General Superintendent
Public Service Electric Company
Newark, N. J.

The relative advantages of hand versus automatic stoker firing of boilers is usually a matter of local conditions and limitations.

For eastern conditions the question may be briefly answered as follows:

Hand-firing Advantages:

A. Low cost of furnace equipment.
B. Low cost of maintenance.
C. Ability to use low-priced fuel. (Anthracite.)

Hand-firing Disadvantages:

A. Reduced efficiency of operation.
B. Limited capacity available. (Particularly with anthracite coal.)
C. High labor cost.
D. Inability to fire bituminous coal without objectionable smoke.

Stoker-firing Advantages:

A. High efficiency of apparatus.
B. Low labor cost.
C. High capacity.
D. Practically smokeless combustion.

Stoker-firing Disadvantages:

A. High initial cost of installation.

B. Comparatively high maintenance cost.

In every case, comparison and choice of two methods of firing must be made after consideration of the cost and character of the fuel, cost of installation, maintenance and operation and local requirement as to smoke production.

J. P. Sparrow, Chief Engineer
The New York Edison Company
New York.

Automatic stokers are cheaper to operate than hand-fired furnaces because they require very much less labor to operate, although stoker firemen probably would command somewhat higher wages. Stokers should be more efficient than hand-fired furnaces because there is very little occasion for doing anything to the former while in operation which will admit drafts of cold air into the furnace. Properly designed and operated under reasonable conditions, a good automatic stoker should be smokeless in operation. They also should be self-cleaning, although only a few of the stokers on the market to-day have this qualification. A large power plant equipped with automatic stokers will have only a few men in the fireroom, whereas in a hand-fired plant there will be a large number of employes. The first cost of an automatic stoker installation is much greater than that of an equivalent capacity hand-fired furnace and to obtain the full advantages of auotmatic stokers the coal should be brought to the stoker hoppers by machinery. The repair and renewal charges on automatic stokers average considerably greater than on hand-fired furnaces. The higher fixed charges and repair and renewal expenses of the automatic stoker are however more than offset by the saving in operating expenses.

If the smoke is not an important factor it is doubtful if an automatic stoker installation would be justified in a station of less than 1000 horse-power.

I. E. Moultrop
Boston, Mass.

In the best types of stokers the fire should be in a clean condition at all times. The fire receives the coal uniformly in small quantities and should, therefore, run at the highest efficiency without smoke.

The labor should be very much less than with hand firing because the machinery does the heavy part of the work and the operator should have nothing more to do than adjust it. In hand firing the operation of putting the coal into the fire box necessitates opening the furnace doors which admits a great deal of cold air and cuts down boiler efficiency. The coal is usually fired in too large quantities at

each firing for the best efficiency. The operation of cleaning the fires necessarily puts the boiler out of commission for a considerable period of time. Building up the fire again to a working condition is usually attended with a great deal of smoke in soft-coal plants.

The repairs are usually much greater on stoker plants than on hand-fired plants on those types of stokers which have the fire in direct contact with the grate. Hand-fired furnaces usually have a film of ashes between the grate and the live fuel which protects the iron of the grate from the heat.

Due to the reduction in the number of men and the better efficiency it seems desirable to employ stokers in all large fire rooms.

C. N. Parker
Boston, Mass.

5—8. Has there ever been a satisfactory solution for scale in boilers in a plant running noncondensing and using very hard water? If so, what is it?

Usually, there are no chemicals that can be used to make a very hard water satisfactory for boiler purposes.

To properly answer this question it would be necessary to have a sample of the water or an analysis of it. If either one was furnished it would be very easy to determine what chemicals would make the water the most satisfactory for boiler use.

H. P. Wood
Brooklyn, N. Y.

5—9. Why were the boilers in the Interborough Rapid Transit Company, New York, arranged so as to use a stoker in the rear of the boiler setting as well as one in the front? What are the advantages of this, the maximum capacity and efficiency of these boilers with a double furnace? Also if same would be recommended, and cost of maintenance, as compared with boiler setting before change.

The stokers in the rear of the boilers in our 59th Street plant were placed there to increase the output of the boilers; in other words, to add grate area.

The advantages derived by this arrangement are that the maximum capacity is increased in direct proportion to the increase of grate area, the efficiency remaining practically the same, except that the efficiency at high loads, is, of course, very much better than it was with the single stoker forced to the same point; in other words, with the Roney stoker there is a critical natural draft from which the efficiency of the stoker decreases. It is therefore obvious that the addition of increased grate area means that the same efficiency can be carried up to a much higher point than it could with the single stoker. As a matter of fact, the boilers having two stokers are operated at from 180 per cent rating to 225 per cent rating.

The cost of maintenance is proportionally the same as before. There is no virtue of two stokers over one stoker, provided you can get the necessary grate area in any other way, or burn an equal amount of coal with the same efficiency, but with a given boiler setting and an installation of a stoker in front of a boiler the capacity of the boiler can be practically doubled by adding a stoker in the rear.

H. G. Stott, Superintendent Motive Power
Interborough Rapid Transit Company
New York.

6—1. Would it be advisable to use a 4-valve engine over a simple valve of the same type engine, for a 300-horse-power direct-connected unit with 1½-inch net-and-slack coal at 75 cents per ton delivered in your bin?

(Three replies in December BULLETIN, all advise use of 4-valve engine.)

The particular instance cited does not give sufficient information to enable this question to be decided offhand, as many other factors enter into the problem and have considerable bearing on the result. For instance: In the case cited, is the engine simple or compound? A simple, high-speed, slide-valve engine will show a poorer steam economy than a slow-speed Corliss engine. The high-speed engine, however, when changed to a compound will show a greater per cent increase in economy than will a Corliss or 4-valve engine under the same conditions, though seldom so great as to offset the initial difference.

Is there any use for exhaust steam in heating or industrial purposes? An extreme case might be cited in which the exhaust-steam requirements exceeded the steam consumption of the engine, in which case it would be good economy to install the cheaper type of apparatus with the poorer steam economy. Let the following conditions be assumed:

(1) Simple, slow speed Corliss engine—steam consumption—32 pounds per indicated horse-power hour.

(2) Simple, high speed, automatic slide-valve engine—steam consumption—40 pounds per indicated horse-power hour.

In both cases 100 pounds steam pressure at throttle, 1 pound back press, cutoff at ¼ stroke, average load of 250 horse-power, 10 hours per day, 26 days per month, and 12 months per year, and a boiler evaporation of 8 pounds steam per pound coal is assumed.

(1) Cost of fuel per year $\frac{250\times32\times10\times26\times12\times\$.75}{2000\times3}=\$1,170.00$

(2) " " " " " $\frac{250\times40\times10\times26\times12\times\$.75}{2000\times3}=\$1,462.50$

Saving $= \$292.50$

Capitalizing this saving at 15 per cent per annum to allow for interest, depreciation, taxes and insurance would warrant an additional investment in the Corliss engine of $\frac{\$292.50}{.15} = \$1,950.00$ on the basis of steam economy alone.

If the engines were compound, the water rates might be assumed as 24 and 28 pounds, corresponding to a coal consumption of 3 and 3.5 pounds per indicated horse-power hour, respectively. Under these conditions, fuel for the Corliss engine would cost $877.50 per annum, and for the slide-valve $1,023.75, a difference of $146.25. The difference would warrant an additional investment in the Corliss engine of $973, only about one-half as much as is warranted in the simple engines.

W. H. Lines
Rochester, N. Y.

6—8. Based on a 100-kilowatt unit, supplying a load varying from 12-kilowatts to 80-kilowatts, with 12-kilowatts for about ten hours out of twenty-four, which unit would give us the best all-day efficiency:—An A. C. condensing steam turbine unit, a direct connected, single valve, high speed unit noncondensing, or a medium speed, four-valve noncondensing unit.

What is the efficiency of each of these units in pounds steam per kilowatt-hour for ¾ load, for ½ load, for ¼ load, for 1/5 load, for 1/10 load?

It would probably give better all-day efficiency under the conditions mentioned, to use two or three units instead of one. A 75-kilowatt 4-valve unit and a 25-kilowatt single valve unit, or three 30-kilowatt single valve units would be combinations worth considering.

If the choice of the 100-kilowatt unit were irrevocable, the 4-valve unit would be the best, everything considered.

In the following table columns II and V are calculated from makers' tests, and columns I, III and IV are an average of values attained in good practise.

In column II the average boiler pressure is 115 pounds and the average vacuum is 26 inches of mercury. In other columns, 100 pounds steam pressure is assumed and exhaust into the atmosphere.

POUNDS OF STEAM PER KILOWATT-HOUR.

	Kilowatt Turbine Unit		100 Kilowatt Single-Valve Unit	100 Kilowatt 4-Valve Unit	
LOAD	I	II	III	IV	V
Full	44	26	56	42	38
¾	48	27	58	43	39
½	62	35		57	49
¼	94	51		92	74
1/5	104	58		107	85
1/10	164	95		182	140

H. M. Cook
Brooklyn, N. Y.

6—4. We have a 100 and a 50 horse-power Westinghouse compound engine, separately belted to a 75 and a 40-kilowatt Westinghouse 60-cycle alternator respectively. Run dark hours till midnight; morning run 6 months in year. Maximum load—winter, 70-kilowatts; summer, 40-kilowatts; coal best Iowa steam, $2.45 in bin. Two H. T. boilers but only one outfit used at a time. To save coal what would be best change, with least expense? State probable saving. Which engine would be best, and size, Corliss slow speed, Skinner high speed or Corliss 4-valve?

From the incomplete information supplied in the question, one is inclined to believe that the saving in coal which might be effected by the installation of a new engine would be offset by increased fixed charges unless the present engines are in poor condition, or an increase in the number of hours run per day is contemplated.

C. A. Graves, Power Engineer
Brooklyn, N. Y.

8—4. (a) Has any member company had occasion to compete with crude oil engines?

(b) We would like data on the performance of oil engines from 50 horse-power to 150 horse-power.

(c) If possible, we would like information as to the cost of delivering current at switchboard, also whether this type engine will operate without an attendant.

(d) Also give data as to the performance of this engine under various loads, ¼, ½, ¾ and full load, and as to its reliability.

An oil engine electric power plant of the size in question will cost about $130 per kilowatt of capacity, not including building. The fuel oil required under operating conditions will be .147 gallons per kilowatt-hour at full load, .16 gallons per kilowatt-hour at three-quarter load, and .174 gallons per kilowatt-hour at one-half load. In the table below is given the cost of producing power by such a plant of 100-kilowatts capacity, on the basis of an 80 per cent, 10-hour load factor.

It is to be noted that the part of the cost which is independent of the load in the plant represents 82 per cent of the total cost, and that consequently for load factors under 80 per cent, the cost increased very rapidly per unit of output. Furthermore, a steam heating plant is necessary in addition to the power plant, which eliminates the cost of heating as a comparative factor in the problem. Constant attention is required if an uninterrupted service is expected.

100-KILOWATT OIL ENGINE PLANT

Investment $13,000.

COST OF POWER.

Interest at 6 per cent on $13,000	$780.00
Depreciation 10 per cent on $13,000	1,300.00
Insurance and taxes	260.00
Profit on investment 10 per cent	1,300.00
Crude oil at .16 per kilowatt, $.03 per gallon	1,152.00
Labor—$18 per week	936.00
Water, 6 gallons per horse-power hour at $.06 per M	126.00
Lubrication, waste, supplies	200.00
Repairs (average of several years)	400.00
Emergency service	200.00
Total	$6,654.00

Kilowatt-hours generated, 240,000
Cost per kilowatt-hour, $.0277

The Toronto Electric Light Company, Ltd.
Aldis E. Hibner, Assistant Power Engineer
Toronto, Canada.

We are having competition with crude oil engines both of the two- and four-cycle type. As a general rule, however, when the prospective purchaser is made acquainted with the many poor operating features of such an engine, together with its high maintenance cost, he refuses to invest his money in such an expensive experiment when he can procure central-station electric power at a reasonable rate.

A drop forgings concern near here have recently installed a 170 horse-power twin cylinder oil engine which furnishes power by means of belt drive to their various machines. They claim the following results were obtained in an 11-hour run.

Fuel oil consumed, 70 gallons at 2.8 cents	$1.96
Cylinder oil consumed, 1½ gallons at 24¼ cents	.36
Engine oil consumed, 2 gallons at 13½ cents	.27
Kerosene oil consumed, 1½ gallons at 8 cents	.12
Grease and waste consumed	.05
Engineer, 11¼ hours at 32½ cents	3.66
	$6.42
Depreciation and repairs, $10,000 at 10 per cent per annum	$3.33
Interest on investment, $10,000 at 6 per cent per annum	2.00
Insurance and taxes, $100 per annum	.33
	$5.66
Total day's cost	12.08

It is not known what load the engine was carrying—the owners claim 100 horse-power, but we believe an average load of 50 horse-power over the 11-hour run is approximately correct, which would make the cost about 2¼ cents per horse-power hour. The above report makes no mention of the amount of cooling water required, which is about 8 gallons per horse-power hour.

It has been my experience that the oil engine salesmen in figuring operating expenses with a customer make mention of only the fuel-oil item. This is less than 20 per cent of the total power cost for a load factor of about 30 per cent. We know of no oil engines being operated without a skilled attendant in the engine room.

We have authentic information that the Baldwin Locomotive Works, Philadelphia, Pa., operating about 5000 horse-power in oil engines, are now figuring their depreciation and maintenance accounts at 20 per cent instead of 10 per cent, and that from their experience they recommend the installation of one spare oil engine to every three needed to carry the load in order to insure equal certainty of operation as obtained with a steam engine.

M. C. Gilman, Power Engineer
Virginia Railway and Power Company
Richmond, Va.

Following is the result of an actual test on an oil engine plant consisting of 1-170 H.P. 2-cylinder unit, during a period of one month:

Capital cost includes	5 per cent interest
	5 per cent depreciation
	2 per cent for maintenance and repairs
A total of	12 per cent

In the capital cost is also included the cost of buildings. I would also say that the annual average for the first year figured out, 1.59 cents per kilowatt hour, as delivered at the switchboard.

Labor and material used for one month:

1452 gallons fuel oil at 2¼ cents	$32.71
30 " cylinder oil at 23.6 cents	7.08
8 " engine oil at 21.6 cents	1.73
7 " gear oil at 30 cents	2.10
5 pounds cup grease at 10 cents	.50
9 " wipers at 13 cents	1.17
25 gallons kerosene at 11 cents	2.75
800 feet gas for power at 85 cents—1000 feet	.68
230 " " for lights at 85 cents—1000 feet	.20
Labor and attendance	59.13
	$108.05

Kilowatt hours produced, 15,270.

Cost per kilowatt hour	.0071
27 days operated capital charge at $6.20 a day....	$167.40
Capital cost per kilowatt hour	.011
Labor and material per kilowatt hour	.0071
Total cost per kilowatt hour	.0181

Hours operated, 270.

Average load 56.7 kilowatt or 49.2 per cent.

Parker H. Kemble
Brooklyn, N. Y.

10—35. When a station is to supply about 300 kilowatts in 60-cycle-polyphase load and about 100 kilowatts in railway load, is it better to use a motor generator or an engine-driven generator for the railway load?

A 100-kilowatt motor-generator would operate satisfactorily, providing a Terrill regulator was used in the field of the alternator. We assume that the 300-kilowatt alternator is operating 24 hours a day.

E. P. Gosling, Superintendent
Old Colony Street Railway Company
Newport, R. I.

Unless your load is equally balanced between your lighting and railway load, the latter is very apt to disturb your voltage badly. Should your railway business justify the expense, an engine-driven generator would be best for the railway load.

J. H. Enright, Manager
Frederick Gas and Electric Company
Frederick, Maryland

Assuming that the A. C. and railway loads are carried at the same time, and that the engine and generator have sufficiently good regulation to take care of the necessary fluctuations in the railway load without objectionably affecting the regulation of the A. C. system, a motor generator set, or preferably a rotary converter, would seem to be a better proposition than an engine driven railway generator, both in first cost and efficiency.

A. S. MacDowell
Rochester, N. Y.

Would recommend the use of a 100-kilowatt rotary converter rather than either a motor generator or separate engine-driven generator. Sixty-cycle rotaries are giving very satisfactory service on this class of work and station losses would be minimized with such a layout.

C. W. PenDell
Chicago, Ill.

A decision in a case of this nature can only be arrived at when the existing local conditions and the quality of service demanded by the public supplied, are fully appreciated. For example, if this is a proposed undertaking to supply a small community, the service naturally will not be very important and occasional brief interruptions may be tolerated, such that reserve machinery would be limited to the smallest extent possible on account of the burden of fixed charges in small plants. On this assumption, it would appear best to provide separate prime movers for the alternating current and direct current loads, so that if no duplicate machinery were installed, both systems would not be crippled in event of a mishap to the single engine. As regards the economy of the two arrangements in a steam station, there should not be any material difference in either fuel or first cost when it is borne in mind that the gain through the use of a single large engine will be offset by the losses and extra electrical investment in the converter.

Edwin D. Dreyfus, Commercial Engineer
The Westinghouse Machine Company
East Pittsburg Pa.

We have almost the same identical load here, and greatly favor the synchronous motor generator set for the street railway. We have the engine-driven generator for use in case of breakdowns, either of the prime mover or of the motor set, and find that the engine-driven generator has been idle for over a year. In this time of "floating rotary condensers" there has been added another argument in favor of the motor generator.

R. A. Brooks, Secretary
Bristol Gas & Electric Company
Bristol, Tenn., Va.

If the present generators are direct connected, making it necessary to install an additional engine, it would be best to install a motor-generator or a rotary. Should the distance between the station and the point where the railway current is to be used be such as to cause a considerable drop in pressure, it would be most economical to install a rotary at the central point of the railway load, of course comparing cost of fuel with the expense of an extra man to take care of the rotary to determine which is cheaper, to employ extra help or lose pressure in transmission.

The railway line can be operated by alternating current from the station by series A.C. commutator type railway motor, using a transformer for variation in speed. A motor of this type will start under heavy load. There are several roads in operation which run from an A.C. system, using step-down transformers to car line.

F. L. Leitner
Brooklyn, N. Y.

The Kenosha Electric Railway Company, of Kenosha, Wis., has an average railway load of about 90 kilowatts and a maximum railway

load of about 300 kilowatts. A 200-kilowatt, 3-phase, 60-cycle, synchronous converter was installed, in preference to a motor-generator set, or a separate steam driven unit, because it is more economical at loads for which it is used, and can be made to give a leading power-factor at heavy loads and thus raise the power-factor on the alternating-current generator, which is also carrying a motor and lighting load.

Lewis A. Pease
Chicago, Ill.

10—86. Is it practicable to operate a 50-kilovolt-ampere, 3-phase, 60-cycle revolving-field alternator as a synchronous motor. If so, what efficiency would it have at full load and at half load?

Yes. The efficiency would be dependent on the design, etc., and would be about 80 to 90 per cent.

R. M. Stevenson
Brooklyn, N. Y.

Practicability would depend largely on the characteristics of the machine, but in general, such an alternator could be used as a synchronous motor if proper provision were made for starting. Efficiency at all loads should be approximately the same as at the equivalent generator loads.

John C. Parker
Rochester, N. Y.

10—87. A heavy 230-volt short-circuit occurred on the line of a three-wire private plant. One 230-volt generator and a balancing set were in operation. The short-circuit burned out five sections of the balancer set starting box. How could this occur, both generator and balancing set being protected by circuit-breakers?

From the meagre information given I should draw the conclusion that the burning out of the balancer starting box was due to a slow or inoperative circuit breaker.

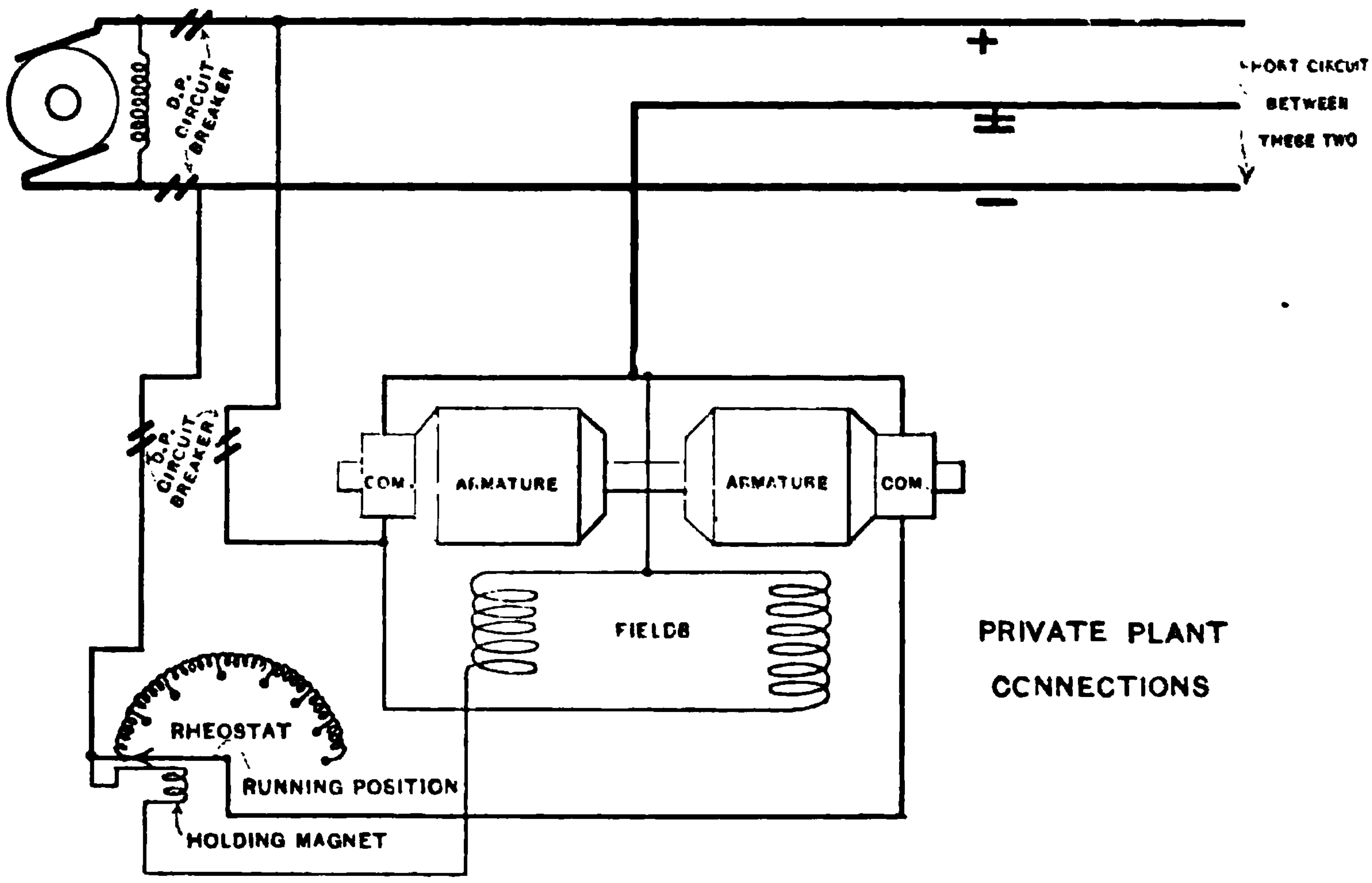
Geo. W. Teffeau, Jr.
Willimantic Gas and Electric Light Co.
Willimantic, Conn.

After viewing the sketch of the private plant connections where the rheostat in one of the armature circuits of the balancer set was damaged, I can see no cause for the burning out of the rheostat referred to from any legitimate reasons. It should be evident that with the rheostat arm in the position shown in the sketch and all other conditions as shown in the sketch, it would be impossible for any current to pass through the rheostat coils, except in case of a ground or defect in rheostat which permitted, under short circuit conditions, a heavy current to flow from some point in the rheostat windings to one of the outside wires at the moment of short circuit. It would seem plausible to think that some connection or defect of this kind must have existed, as

it is contrary to either theory or practise to have current flowing anywhere through rheostat windings connected as shown in the sketch when the rheostat arm is placed in the running position.

L. L. Elden
Boston, Mass.

[The sketch referred to is appended. It was sent to Mr. Elden with a request that he furnish, if possible, a solution of this interesting problem.—Editor.]



10—89. The efficiency of an 185-kilowatt, 6600-volt, 60-cycle generator was figured to be 93 per cent at full load by measuring the separate losses. It was reported that if the load losses had been included in accordance with the A. I. E. E. rules, the efficiency should have appeared to be 92 per cent.

What rules do the A. I. E. E. give for computing the efficiency of an alternator?

This was probably a direct-connected generator. The A. I. E. E. rules call for all losses including friction of bearings. Manufacturers usually consider the bearing friction as part of the engine loss in direct-connected machines.

H. L. Wallau
Cleveland, Ohio.

The rules of the A. I. E. E. referred to, will be found on pages 10 and 11 of a publication entitled "Standardization Rules of the American Institute of Electrical Engineers." After giving various sources of loss to be computed in connection with the apparatus itself, paragraph 144-I refers to load losses in the following sentence:—"The

load loss may be considered as the difference between the total losses under load and the sum of the losses above specified."

F. W. Morris
Brooklyn, N. Y.

10—40. Could we expect good results with a two-phase generator supplying two separate single-phase circuits, one circuit No. 8 wire supplying mixed lighting and motors, the other circuit No. 6 wire supplying purely lighting, by using a buck and boost feeder regulator on one circuit only?

Nearly as good results would be obtained by installing one automatic regulator on motor-circuit as would be received if two were installed.

The only advantage gained by the installation of a second regulator on your lighting circuit would be that it is then automatically controlled, and the switchboard operator would not have to adjust it, when the load drops off and comes on.

H. P. Wood
Brooklyn, N. Y.

Best results could not be expected with a variable load if one non-automatic feeder regulator was used, as any adjustment of the machine pressure to correct the pressure on the circuit having no regulator would also affect the pressure of the other circuit having a regulator, which would then have to be readjusted. If the regulator was automatic the pressure would be corrected automatically but then the other circuit would still be non-automatic.

The best practise would be to have two automatic motor-operated feeder regulators, but if the expense was not justified, on account of a small lighting load, two feeder regulators of the non-automatic motor-operated type should be used.

G. E. Brown
Brooklyn, N. Y.

10—41. On account of the poor regulation of our generators and engines under motor load we are thinking of installing a modern 100-kilowatt unit. Our present efficiency in lbs. of screenings per kilovolt-ampere at switchboard is 7.4 lbs. (Corliss engines belted to generators through medium of jackshaft.) We do not wish to expend over $5,000. What will be the best unit for us to install?

This questioner seems to base the necessity for new installation entirely on the fact that his generators give poor regulation. If the conditions are such that the generators can be governed by an automatic voltage regulator, it will possibly help to better the regulation of the plant to such an extent as to make the installation of a new plant unnecessary.

F. W. Shackelford, Supply Department
General Electric Company
Schenectady, N. Y.

I question if any 100-kilowatt unit would be a satisfactory remedy for the trouble. Such a small generator cannot have good inherent regulation. If direct connected to a high-speed engine it is doubtful if it would give any improvement in fuel economy. And it is a question whether the new small unit would run satisfactorily in multiple with the existing units.

In such cases in my past experience, I have found that the best and cheapest remedy for poor regulation under motor load, was a single big generator, either direct coupled to the jack shaft or belted to it by a wide soft belt. The regulation of a big generator under motor loads is much better than the regulation of a lot of small ones. Belt creep would be much reduced and the Corliss engine regulation can in most such cases be made satisfactory.

While a reference to furnace and boiler economy is not called for by the question, I take leave to say that in most plants, such as described, there is more fuel to be saved by study of furnace and boiler conditions than by any practicable change of engines, unless the change be from noncondensing to condensing operation.

Alex Dow
Detroit, Mich.

10—42. A central station of 15,000-kilowatt capacity has a ratio of motor load to lighting load of 2:3, and operates at 72-power factor. Is this fair operation, and what equipment is required to raise power-factor to 88?

There are three methods of improving the power-factor of a mixed power and lighting load. I presume that the motor load consists largely of induction motors.

The first, and probably the most important, step is to have periodic inspections of what might be termed the consumers' devices, including transformers. This would include the checking of transformers to see that they are in proper proportion to the load; and it is important to see, more particularly, that the size of the motors is the proper size for the work which they are doing. Very frequently in manufacturing establishments, owing to changes in the class of work that is going through their shops, the size of a motor will be entirely too large for the work it is doing, and motors in other parts of the shop may be overloaded. A rearrangement of the motors, so as to avoid motors running at light load, will improve the power-factor as well as benefit the consumer by giving him more efficient and economical equipment.

The second method is by the use of synchronous motors, or synchronous apparatus such as rotary converters, in the substations of the company—adjusting the fields so as to improve the power-factor of the generating plant.

The third method is the operation of an idle machine in the generating station, adjusting the fields so as to improve the power-factor of the station. This can be very easily accomplished in the

generating plant, by bringing the turbine up to speed and synchronizing it, and then shutting off the steam and operating the generator as a motor. This is particularly advantageous in the summer months, when the power-factor is the lowest, and when the temperature in the station is the highest. By improving the power-factor, the generating units can be operated at practically full load, with a safe temperature rise.

W. C. L. Eglin
Philadelphia, Pa.

With a load of 15,000 kilowatts and a power-factor of 72 per cent, the wattless component of this load is equal to

$$\sqrt{\frac{(15000)^2}{(.72)} - 15000^2} = 14,460 \text{ K.V.A.}$$

The wattless component of the load, if it were of 88 per cent power-factor, would be the square root of the quantity:

$$\sqrt{\frac{(15000)^2}{(.88)} - 15000^2} = 8,110 \text{ K.V.A.}$$

The difference between these wattless components would represent the capacity necessary for raising the power-factor of this load from 72 to 88 per cent. It is probable that the load may be so distributed that certain feeders have a larger proportion of the power load. If this is the case it would probably be preferable to use several rotary condensers distributed on these feeders of low power-factor, preferably near the centre of distribution, as this would reduce the feeder losses and transformer losses.

C. W. Stone, Consulting Engineer
General Electric Company
Schenectady, N. Y.

A power-factor of 88 is not to be expected without the use of underloaded or heavily over-excited loaded synchronous motors.

A considerable improvement in power-factor may be secured, and at the same time idle investment set free, by investigating motor and transformer sizes. If the transformers are too large, they will keep on the lines at all times a lagging load of charging current, which can be greatly reduced by reducing the size of the transformers. In connection with the lighting transformers, this reduction may be made even so extensive as to utilize the overload capacity of the transformers for short hours. Motor sizes should be looked into in the same way, utilizing the overload capacity of the motors in all cases where the overload will not be protracted.

John C. Parker
Rochester, N. Y.

A large amount of underloaded inductive apparatus and the long transmission line are the probable causes of the low power-factor in

this case. There are two possible ways of raising the power-factor in this system:

1. To run every motor at approximately its rated load, and to install transformers with low core losses which take only a small magnetizing current at the normal system load but of large enough capacity to take care of the maximum system load.

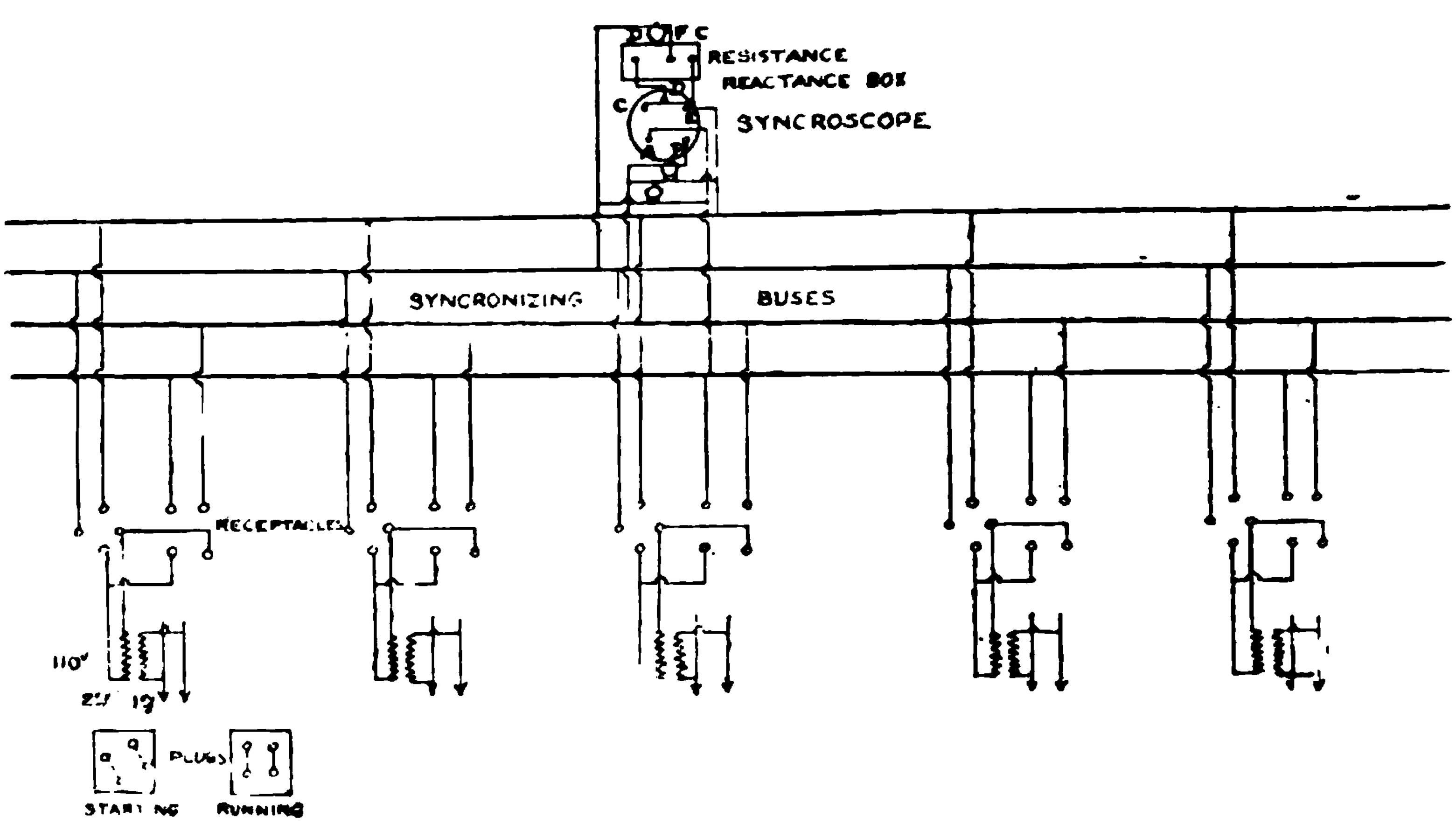
2. To install rotary condensers.

The first method is not a practical one, because customers must run their motors at the load which their business demands, and because the installation of new transformers would be too extravagant. The Sales Department can, however, advise new customers as to the design and size of motors which will take care of their business and at the same time give the best power-factor to the line. The installation of motors of too large a capacity is a common mistake.

If possible customers should be induced to use synchronous motors, if motor-generator sets are used in the substations, synchronous motors of somewhat larger capacity than the generators should be used. If none of these could be done to advantage, it would probably pay to install a synchronous motor at one of the substations and run it idle or partially loaded. This would improve the power-factor of the generating station and transmission line.

H. M. Cook
Brooklyn, N. Y.

11—17. Please give sketch of connection of syncroscope (G. E.) on two-phase four-wire board with five machines.



The field connections are made through binding posts A and B. The armature consists of two coils at right angles to each other. Their junction is brought out through a collector ring to binding post E. The two terminals of the armature are brought out through collector rings

to binding posts C and D. One terminal passes from D through a reactance to binding post F, and the other terminal passes from C through a resistance to binding post F. E and F are connected to the synchronizing buses excited by the machine that is being synchronized. The starting and running connections are shown by the plugs.

H. M. Cook
Brooklyn, N. Y.

11—18. Have member companies experienced any difficulty with moving-picture theatres unbalancing line voltage due to moving-picture arc being on one side of system? On alternating-current circuits are 220-volt economizers used? What are the local Board of Fire Underwriters' rulings in reference to 220-volt economizers?

(Replies from Philadelphia, Chicago, Denver, Boston and G. E. Co. in January BULLETIN.)

We have a number of moving-picture arcs which previously used 220-volt direct current, but have been changed to 220-volt alternating current and use mercury rectifiers. The rectifiers are equipped with auto-transformers which drop the voltage to the value required by the arc, and as our secondary distribution is 220-volt, 3-wire, we of course experience no unbalancing. The direct current is used for elevators and picture arcs only and under those conditions no attempt is made to obtain the regulation required on a lighting system. The rules of the National Board of Fire Underwriters are a part of the city ordinances and govern the installation of all electrical apparatus.

Lloyd Garrison
Utah Light and Railway Company
Ogden, Utah

11—19. A 50,000-volt to 13,000-volt substation is so designed that 50,000-volt charging current on transformers must be broken by air-break switch. Electrolytic arresters are maintained on 50,000-volt lines. Does this operation endanger our apparatus or 13,000-volt cable?

Regarding the possible danger of opening the 50,000-volt charging current of substation transformers by an air-switch, I should consider such operation to involve some danger, and therefore as undesirable and to be avoided except in emergencies.

The opening of a high-voltage circuit is safe or relatively safe only when taking place at or near the zero of the current wave. Air switches, however, frequently have the tendency to rupture the circuit at or near the maximum of the current wave, and thereby are liable to produce serious disturbances in the circuit, even if the amount of current is fairly small. The reason of this undesirable feature of the air switch is the following: The air switch opens by an arc. The resistance of the arc stream, however, is very low, and the arc thus can

follow the switch for a considerable distance without consuming much voltage. That is, the circuit is not opened gradually by the increasing resistance of the arc, but usually is opened long before the arc resistance has become appreciable, by the arc stream rupturing, more or less explosively, by the heat of the arc. Since the heat is obviously a maximum at maximum current, this gives a tendency to rupturing near the maximum current, or at the wrong point of the wave.

It appears therefore safer to avoid opening air switches in the high potential line, even when carrying only the exciting current of the transformer. As I do not know the conditions of the particular instance, I cannot judge about it, but in general would think that the high potential switching might be avoided in all cases except where it becomes necessary to disconnect a transformer from the line, while leaving the line alive. When starting up line and transformer, it is far safer to connect the transformer to the line, while the line is still dead, and then connect the line together with the tranformer to the generating system. Inversely, when disconnecting, line and transformer are preferably taken off the generator together, and after this, when the line is dead, the transformer disconnected from it. This has the advantage that the line acts as capacity shunt for the transformer, and thereby absorbs whatever high frequency oscillation the transformer may produce, and the transformer as shunt discharges the line, so that the possibility of danger is very materially reduced, when line and transformer are kept together when connecting in and taking out of the circuit. Obviously, this is not feasible in all cases, but it is advisable to realize that in high-voltage circuits the combination of line and transformer is far safer than either alone.

As regards protection by electrostatic arresters: These arresters protect the conductors to which they are connected against a rise of voltage above normal. It must, however, be realized that no arrester can protect unless the voltage rises above normal, and in spite of arresters, damage may therefore result locally by high-frequency currents. If the voltage of the high-frequency currents produced by switching, etc., is very much less than line voltage, it obviously cannot be expected to discharge over the lightning arresters. Due to the high frequency, however, voltages may pile up across reactive parts of the circuit, as at the end turns or at some intermediate turns or coils of transformers, on current transformers, potential regulators, etc., and these voltages, while less than the total line voltage, frequently are, due to the high frequency, far higher than the reactive parts of the circuit, as the turns of the transformer, etc., can stand, and pin-hole punctures thus result, which finally lead to a breakdown.

Charles P. Steinmetz

Schenectady, N. Y.

Air-break switches will not open the several poles of the circuit simultaneously. Therefore, when these switches are opened on 50,000-volt side, a disturbance may be expected on the 13,000-volt side, due to static induction between the primary and secondary transformer coils. Electrolytic arresters on the 50,000-volt side will not prevent a rise in voltage due to this cause. Electrolytic arresters on the 13,000-volt side should be installed to discharge their static charge.

If transformers are first disconnected on the 13,000-volt side (preferably by an oil switch) any subsequent disconnection on the high-tension side would not affect the 13,000-volt out-going cables. This arrangement is especially desirable if the cables are ungrounded and lead covered.

The above conclusions are based on the assumption that the system is delta connected and ungrounded on both sides of the transformers.

Harry M. Hope
Stone and Webster Engineering Corporation
Boston, Mass.

We do not believe that any serious disturbance would occur on the 13,000-volt circuit as a result of such operation of the switch, although we know of no particular experiment or trial which has been made to demonstrate the matter.

R. P. Jackson
Westinghouse Electric and Manufacturing Company
Pittsburgh, Pa.

We have had in operation since February 24, 1909, one 44,000 to 2300-volt substation arranged as stated in question, except that we do not have leaded cable on the 2300-volt side. The line at this point is not protected by electrolytic arresters. We have never had any trouble whatsoever and have never noticed any evidences of strain on the apparatus due to opening the charging current with air-break switches. We have from time to time on numerous occasions operated similar stations temporarily for periods of a month or so at a time and have never noticed any evil effects. The capacity of the station above mentioned is 3-1000 KVA transformers.

Southern Power Company
Charles I. Burkholder, Mgr. Operating Department
Charlotte, N. C.

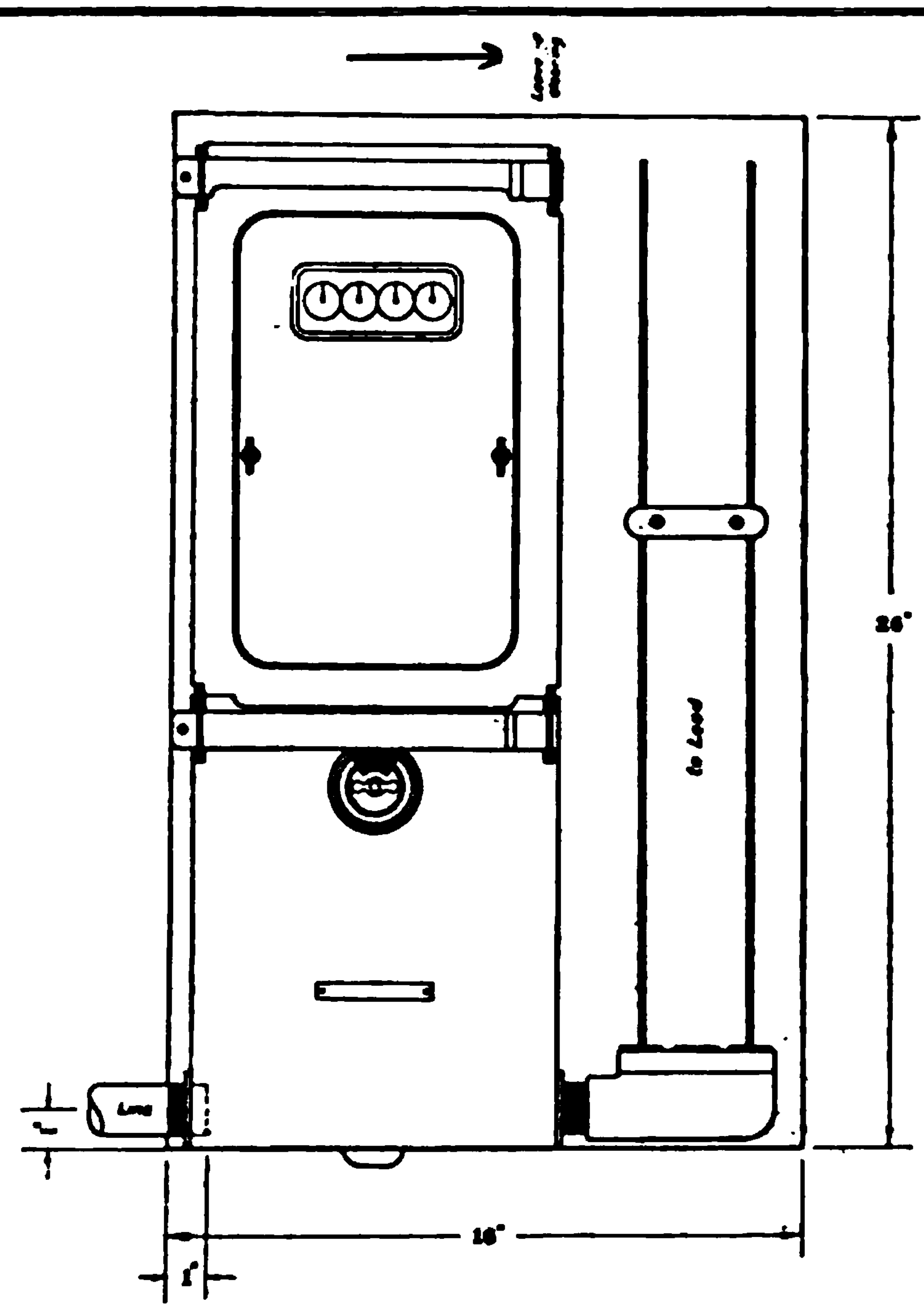
12—82. What is the method employed by member companies in bringing in service from overhead lines to connect with house mains in basement or cellar? Is an extra charge made for such service in excess of that for regulation overhead service?

(See November Bulletin for other replies.)

PLACE METER BOARD HERE

READ CAREFULLY

The Buffalo General Electric Company will run the mains from the pole to a point 20 foot from the ground. Customer must run from this point to his load with not less than No. 8 wire which must be enclosed in conduit with approved fittings *UP TO THE METER.* All condulets and boxes between entrance of building and meter must be drilled for sealing. A meter board must be provided for the meter. *ALL DIMENSIONS OF BOARD AND PIPE ENDING* must be as indicated in sketch below. Fuses, switches, etc. *MUST NOT* be placed in this space. If it is desired to place such near meter board must be made larger. *FOUR* inches air space must be left above meter board free from any obstructions to allow covers to be removed from meters. One foot of wire must be left out of line side of meter and sufficient on the load side to connect to meter. Bottom of Meter Board to be 5 ft. 6 in. from the floor.



From 5 up to and including 50 Amp 110 and 220 Volt two wire also up to and including 25 Amp. 220 Volt three wire.

Any changes in the above must be approved by the Company's Inspector. When the above instructions have been complied with, 'phone the Meter Department of the Company (Frontier 3429) for final inspection.

The Board of Fire Underwriters require that your wiring and fixtures be inspected before we give you current.

THE BUFFALO GENERAL ELECTRIC COMPANY

REDUCTION, BUFFALO INSTRUCTION SHEET.

The sketch shown in the figure is our standard instruction sheet, which our installation inspector leaves on customer's premises as soon as contract is signed, or before if requested. When at all possible meters are located in the basement. Wires are brought in conduit to the meter in all cases. We require that this conduit be run up 20 feet on the outside of the building, unless the building be less than 20 feet in height, in which case the conduit terminates under the eaves. The customer is required to put this conduit up and prepare a place for the meter. The company runs service wires from the pole to the conduit overhead, and connects up meter without any charge. In case the customer wants underground service from pole to house, he is required to lay conduit and run same up the side of the pole to a point 20 feet from the ground, and to run approved underground cable in this conduit. He provides a place for meter. His contractor does this at his expense. The company connects from this conduit on the pole to the lines and places the meter without charge to the customer.

E. A. Le Fever
Buffalo General Electric Company
Buffalo, N. Y.

12—36. Our experience has been in case of lightning storms that we have lost transformers close to poor grounded lightning arresters and have not lost a like make of transformer on the same line, but a mile or so away from any arrester, and this leads us to ask the following question: When pole line lightning arresters are properly installed in every way with the exception of the grounding, and that proves to be poor, or the ground wire broken, are such arresters a detriment rather than a protection to the line?

(Other answers in December and January BULLETINS.)

Lightning disturbances are more or less local, and this usually accounts for the burning out of some particular transformers. Assuming that the transformers are of equal insulation strength, a lightning arrester with a poor ground connected in multiple with any one of the transformers is not a detriment to the circuit, but simply does not afford any protection. I believe it is entirely neutral under such conditions.

C. C. Chesney, Manager
General Electric Company
Pittsfield, Mass.

A lightning arrester with a very poor ground or with no ground would be of no protection to adjacent apparatus. The fact that a transformer a mile away on the same line was not injured is, however, no proof that the presence of the lightning arrester near the transformer that was injured was responsible for the injury, since it is fairly well established that the severity of a heavy induced discharge of lightning is greatly modified within a few hundred feet of the point where the disturbance is most acute. The arresters might be a

"detriment" on a line with a poor ground or no ground to the extent that a dynamic current might follow the discharge and cause an interruption of service.

H. B. Gear
Chicago, Ill.

12—28. Will some member company which has used concrete poles tell something as to results and costs?

This company has been making concrete poles for the purpose of carrying secondary mains and telephone cables in residential districts. The neat appearance of these poles makes them less liable to objections from property owners on whose premises we seek permission to place them. Our poles are 35 feet in length, tapering 9 inches at the base to a 6-inch top, and are suitably reinforced with twisted steel rods. The line wires are attached to malleable iron brackets bolted to the poles. The poles weigh in the neighborhood of 2000 pounds, and cost $8.50 each. Erecting costs from $2.50 to $4.00 per pole, according to haul and location. The chief objection to these poles is their great weight, and consequent expensive handling.

J. O. Montignani
Rochester, N. Y.

12—38. What effect has the installation of lightning arresters had on the reduction of burnouts and open circuits on both commutator and induction meters? How often is it found necessary to test lightning arresters?

(Also answered in January BULLETIN.)

The testing of lightning arresters, we think, depends upon the type used. They should be examined at regular periods—the more frequently the better, especially during the lightning season.

C. M. Tolman, Engineer
Bangor Railway and Electric Company
Bangor, Me.

12—39. What method of testing for open circuit is found to be most convenient on arc circuits where tungsten lamps are also used?

(Also answered in January BULLETIN.)

The voltage on series circuits having been increased to a great extent in the last few years, it is first necessary to have an absolute cutout that will stand the high voltage used. The box recommended for this purpose is known as the Weatherproof Oil Break Switch or arc cutout, picture of which is shown herewith.

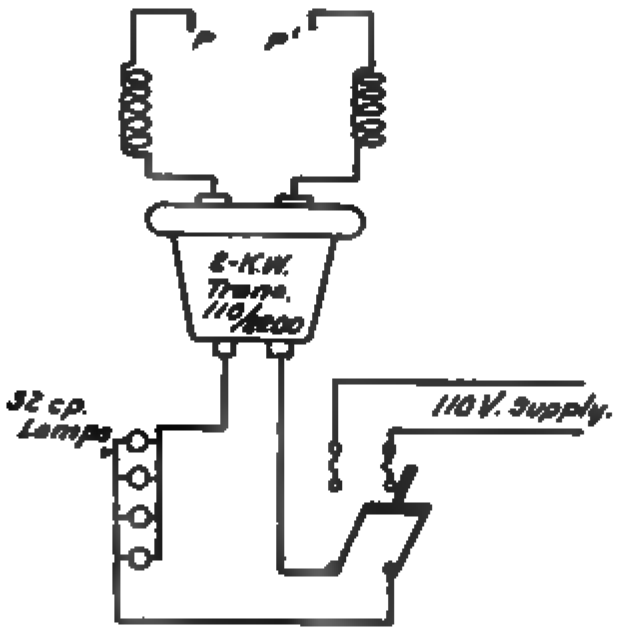
This cutout, when on, allows a series circuit to burn; when off, short-circuits the line and leaves the loop or section protected by it absolutely dead, so that the defective loop may be tested by magneto

with perfect safety and without removing any wires from box. Any number of these arc cutouts may be placed on a long-series circuit (double wire) of arc or incandescent lamps or both and an open

located very quickly by throwing the cutouts off and testing ahead with magneto; this may be done with the circuit alive, so that when the cutout is off the lamps behind it will at once start up.

W. E. Holmes
Cambridge, Mass.

Our method of testing street-lighting circuits having tungsten lamps is as follows:



At 4 P. M. the switch-board man tests each circuit with 50,000 ohm magneto. If one tests "open" he then hooks the primary of a 2-kilowatt 110/2200 transformer across that circuit. The secondary of

this transformer receives current through a bank of 4-32 candle-power lamps in multiple. 2200 volts will break across any socket film cutout. and if the circuit is not otherwise "open" it short-circuits the transformer primary and the lamps burn at full voltage. If the circuit is really "open" the lamps will glow red with the exciting current of the transformer. We use an old transformer which has been discarded from line use on account of excessive iron loss.

A. E. Main, Electrical Superintendent
Hot Springs Water Company
Hot Springs, Ark.

12—40. How long does standard weatherproof insulation on No. 6 wire, installed on a pole line, with ordinary weather conditions, continue to be safe insulation for 2300-volt alternating current?

This is a very hard question to answer because of the fact that there are various makes of weatherproof wire and no two of them are made in exactly the same manner and with exactly the same material.

The life of weatherproof wire in one certain place would be altogether different from the life of the same wire in another place. I have known ordinary weatherproof wire to be in very good condition eighteen years after installation. If the wire passed through many trees where there would be an unusual amount of abrasion, it would be unsafe for 2300 volts in a very short time.

I would hardly like to commit myself to a definite statement that standard weatherproof wire would be safe for 2300 volts after any given period of time without knowing all about the conditions surrounding the pole line upon which it was to be installed.

W. A. Conner
The Standard Underground Cable Co.
Perth Amboy, N. J.

In the writer's opinion, so-called weatherproof insulation on wires is not at any time a safe insulation for conductors carrying a pressure of 2300 volts, and he insists that linemen handling such conductors under his direction treat them as they would bare wires. The permanence of such insulation as weatherproof wire possesses depends altogether on the conditions under which it is used. The deterioration is rapid, for instance, on wires strung over or close to a steam railroad, and subject to the action of gases thrown off from the locomotives, while, on the other hand, the writer knows of wire, exposed only to ordinary weather effects, which was in good condition after fifteen years' service.

John Cox
Rochester, N. Y.

13—12. What companies use cables of over 1,000,000 cir. mils cross-section?

(Other replies in January BULLETIN.)

This company uses cable of 1,500,000 c.m. cross-section for low tension feeder; we also have a limited amount of cable of 2,000,000 c.m. cross-section.

B. E. Strohm
Chicago, Ill.

13—18. Is it practicable to operate distributing systems with manhole transformers where manholes are frequently flooded?

(Also answered in January BULLETIN.)

Wherever possible, this company installs its underground transformers in manholes that are drained. Whenever it becomes necessary to place them in undrained manholes, the manhole must be pumped out at frequent enough intervals to prevent the water getting high enough to do damage. Even with that precaution the company has had a number of transformers burn out, due to water getting into the cases. Of course, the amount of water getting into the manhole depends on the use of ventilated or unventilated covers, and by the position of the manhole in the street, that is, whether it is in the centre or near the gutter, etc. Where the manholes are large enough to allow doing so, this company has dodged some of the water trouble by placing the transformers on the walls of the manholes, or otherwise raising them off the floor, with the idea that if the transformer can be gotten up high enough the ducts themselves will act as drains, and keep the level of the water down by carrying it off to the adjacent manholes, and so on until one is reached which is or can be drained.

D. C. Rockwood
Rochester, N. Y.

14—5. Kindly give values of the resistance of an exide battery from beginning to end of charge.

(Also answered in January BULLETIN.)

The internal resistance of an Exide cell varies inversely as the number of positive plates. At normal temperature this may be expressed in terms of one positive plate by the figures .01 ohms for PV size and .0086 ohms for MV size. This figure holds practically constant throughout about 75 per cent of the discharge, when it begins to increase, and when the cell is discharged to its limiting value the internal resistance is somewhat higher. For example, the internal resistance of a PV-11 Exide cell, which contains five positive plates, is one-fifth of the PV value given above, or .002 ohms. This figure will hold for both the standard Exide and Ironclad-Exide types.

Frank J. Stone
The Electric Storage Battery Company
Boston, Mass.

15—42. Given, a transformer with two separate secondary windings of different capacities and voltages, how much current will flow in each winding for any given primary current when the two secondary windings are short-circuited? Transformer capacity, 500 kilowatts. Primary volts, 11,000 (delta). Secondary winding, No. 1, 500 kilowatts at 440 volts (delta); No. 2, 200 kilowatts at 161 volts (delta).

The current flowing in two short-circuited secondary windings, when the primaries are subjected to line voltage, depends not only upon the relative position of the two secondary windings with respect to each other, but also upon their relative position with respect to primary coils. The magnetic induction at which the iron is worked and the shape of the iron circuit also influence the secondary short-circuit current. Even with all design data at hand, only an approximate answer could be given to this question.

A. H. Timmerman
Wagner Electric Manufacturing Company
St. Louis, Mo.

16—82. What is the average cost, operating and maintenance, per mean spherical candle-power of the following forms of light during the average life of the appliance? Assume oil at 10 cents per gallon; gas at $1 per M; electric power at 10 cents per kilowatt-hour.
Kerosene oil, Rochester burner lamp.
Flat-flame Bray burner, 18 candle-power gas light.
Welsbach upright burner, 18 candle-power gas light.
Tungsten lamp, 60-watt size, 1.25 watts per candle-power.
Enclosed arc light.

(Other replies in January BULLETIN.)

Our experience in competition is that the flat flame gas burner is about on a par with the carbon lamp, and that two 100-watt tungstens will replace one four-mantle gas arc at an operating cost of about 20 per cent less. A flat charge of ten cents per mantle per month is made by our competitors for all renewals; and this, based on about five hours' burning per day, is equal to the replacement charges for the tungsten lamps. We find that one four-mantle gas arc burns about 30 feet per hour, or three cents, while the tungstens use current worth two cents. In soliciting business, we claim 20 per cent decrease in monthly cost. It is our experience that three hundred watts of tungstens will give better light than one electric arc and at a cost proportional about three to five.

Utah Light and Railway Company
Salt Lake City, Utah

16—84. Would the constant temperature in a drying room of 130 degrees F. for 10 hours per day have any effect upon the life of a Gem lamp? Would it tend to shorten its life?

The life of a good Gem lamp is not affected by operating continuously or intermittently in a temperature of 130 degrees Fahrenheit. We have made actual tests under these conditions to prove this statement.

The approximate temperature of the filaments of the Gem lamp operating at normal efficiency is about 3300 degrees Fahrenheit, so that if it is operated in a temperature of 130 degrees Fahrenheit, which is only 60 degrees more than that of a summer temperature of 70 degrees, this slight increase of 60 degrees would not materially increase the temperature of the filament and therefore would not affect the life of the lamp.

Henry Schroeder
General Electric Company
Harrison, N. J.

The effect of a temperature of 130 degrees F. is to very materially shorten its life. This has been repeatedly observed in connection with bake ovens and similar installations.

H. B. Gear
Chicago, Ill.

16—35. What success, if any, have member companies had with 250-watt tungsten lamps?

(See January BULLETIN for other answers.)

It is our practise to recommend wherever possible the use of large tungsten units. The lamps cost less per watt both for initial cost and replacement, are stronger and will therefore stand more abuse, and give slightly better efficiency than the smaller units. The cost of wiring is also less since the number of outlets is usually less. It is true that the cost of replacement is large when a lamp breaks but in the long run is less with large units than with small ones. We have recently installed several 500-watt lamps equipped with a pearly art glass reflector which give an efficiency, as shown by illuminometer tests, fully as high as any other installations in the city.

Lloyd Garrison
Utah Light and Railway Company
Ogden, Utah

We have installed quite a number of big installations of 250-watt tungsten lamps and holophane reflectors, and we find that they are very successful and have a much longer life than they are rated, and, owing to their having such a large wattage, the filament is very strong and will stand more jarring and vibration than any of the smaller-size tungstens.

J. M. Fried, Manager New Business Department
Poughkeepsie Light, Heat and Power Company
Poughkeepsie, N. Y.

We have a number of the 250-watt tungsten lamps, and they have given very good satisfaction. The larger-size lamps are cheaper in proportion to size, of higher efficiency, and less apt to be broken accidentally. I always recommend the largest size that can be used, and yet secure satisfactory distribution.

A. G. Rakestraw
Wilkinsburg, Pa.

17—19. What experience have member companies had with reference to the reliability of underground series incandescent street lighting, using ornamental iron posts? Kindly furnish data and illustrations, if possible.

We have some 150 incandescent lamps mixed indiscriminately in series on a number of our 7.5 ampere constant current alternating circuits, approximate voltage of current being 4000 volts.

These lamps are on iron posts through the center of which lead cable is run to lamp socket. The iron post is securely bonded to lead sheath, no reliance being placed on the mechanical contact of sheath and iron.

The iron posts being set in concrete are to a certain extent insulated, hence the precaution of bonding. No trouble whatever has been experienced with this construction for a period extending over some six years.

T. H. Yawger
Rochester, N. Y.

17—29. What means do member companies use to insure installation of the proper size incandescent lamps in residences; do companies when connecting meter use their own discretion as to the proper size lamps to install in cellar, hallways, etc., or is this information secured beforehand from customers, and if so, through what method?

We make it a special point of instruction of an employe whose duty it is to install meter and lamps, that they shall pay particular attention as to the proper candle-power to install in the fixtures of the residences of our customers, paying particular attention that the lamps be of the smallest candle-power possible to do the work satisfactorily. We believe in installing the smallest candle-power, as the customer can very easily change these lamps to higher candle-power should it be necessary, whereas we do not consider it good policy to have a customer install large candle-power lamps and receive a big bill, and then attempt to decrease the candle-power of his installation.

Thomas F. Kelly, Contract Agent
The Hamilton Electric Light and Power Co., Ltd.
Hamilton, Canada

Here the information is secured beforehand from the prospective customer, by the solicitor, and the number and size of lamps is placed

upon the application. The solicitor assists the prospective customer by suggesting the proper sizes and kinds of lamps for different locations.

Wm. Rawson Collier
Atlanta, Ga.

Upon making application for a meter and service, the consumer is asked the number of lamps wanted, and the sizes. If the consumer gives the number of lamps, but does not know the size, 50-watt Gem lamps are installed with meter throughout the residence. Quite often this information is obtained from the electric contractor or fixture dealer in their report to the company regarding work installed. In cases of large residences, or special installations, an illuminating engineer is sent out to secure the desired information or make recommendations for the consumer.

L. W. Layman
Rochester, N. Y.

When contract is secured, an inspector from the plant visits the premises for the purpose of sizing up the situation and taking note of any unusual conditions. It is part of his duty to count the sockets that are to be supplied. Usually the customer is consulted as to the size of lamps desired. Unless instructed otherwise, we furnish 16 candle-power throughout. Sometimes the solicitor who gets the contract has talked the matter over with the customer and has decided on what sizes are to be used, in which case he turns in a memorandum with the contract. We do not, as a rule, make any suggestions in the matter.

A. G. Rakestraw
Wilkinsburg, Pa.

19—42. Do any member companies specify in their motor rules that all alternating-current motors should be of the wound-rotor type to avoid excessive starting current?

(Also answered in January BULLETIN.)

The following rules and regulations are part of the (North Shore Electric Company) power contract:

"All motors with a rated capacity of thirty-five horse-power, or more, shall be of the slip-ring or wound-rotor type.

"All motors with a rated capacity of ten horse-power, or more, shall be equipped with switches having low voltage release attachments, which will disconnect such motors from the company's lines in case power on said lines is interrupted; one switch, equipped with low-voltage release attachment, on main service, will be considered as fulfilling this requirement."

John G. Learned, General Contract Agent
North Shore Electric Company
Chicago, Ill.

19—48. To what extent have single-phase motors been successful on elevator service?

We had a 15 horse-power single-phase motor in use on an automatic elevator, and found that every time this motor started there was an enormous fluctuation in voltage. This fluctuation affected the motor so that the elevator would not stop level with the floors. When replaced by a three-phase motor the results were perfectly satisfactory. The single-phase motor was operated from a 175-kilowatt generator, and the three-phase motor from a 50-kilowatt, hence, as far as line regulation was concerned, it should have been in favor of the single-phase motor.

R. A. Brooks, Secretary
Bristol Gas and Electric Company
Bristol, Tenn.-Va.

All things considered—quite successful.

The conditions to be met are peculiarly severe and such as are usually not present with either direct-current or polyphase equipment. If the installation is in a large city, it is generally remote from the central station and on a feeder circuit supplying high-class lighting patrons. This means the starting current of the motor must be reduced to the minimum limits, that the lighting service of the district be not impaired. If the equipment is in a small city, it is in a downtown district, with very frequent starting and stopping, and sometimes relatively small feeder capacity. In the large majority of instances the equipments receive little or no skilled attention. Notwithstanding, excellent practical results have been achieved and the number of single-phase installations is constantly increasing.

The elevator manufacturer has developed thoroughly reliable control systems for travel speeds up to 150 feet per minute. This control mechanism is as comprehensive and satisfactory as for the very best of polyphase installations and fairly comparable to high-grade direct-current control systems.

The full push-button control for single-phase equipments is no longer a novelty, but a demonstrated practical success. The motors, while by no means as perfect as corresponding ratings of direct-current motors, nor quite so good as polyphase motors, are nevertheless thoroughly commercial and satisfactory *when provided with adequate control mechanism*. The motor is not so quiet-running as the slip-ring polyphase, because it is of the commutator type; and not so quiet as the direct-current type, because of the hum of the alternating excitation. But the motor has unquestionably demonstrated its complete utility for the purpose, in units of 10 horse-power or less, and for speed travels, as stated, within 150 feet per minute. Its starting current is approximately double full load running current.

As a central station proposition, therefore, it may be considered thoroughly demonstrated, that the single-phase elevator equipment is

limited only by the question of pressure regulation on the feeder circuit. As the power-factor of the starting current is high, its effect on circuit regulation is only slightly worse than that of an equivalent number of amperes of incandescent lighting load.

Comments herein refer, of course, to the commutator type of single-phase motor and not to the split-phase type. The latter is entirely inadequate to the needs of this service. While simple electrically, its torque is inadequate. It is certain the commutator type of equipment will undergo constant improvement and central-station men may, with safety, favor the installation of single-phase equipments, provided the proposed equipment is of high grade. A cheap single-phase installation should not be made, unless it is with the constant-running type of motor with belt-shifting arrangement for starting and stopping the elevator.

W. A. Layman, Vice-President
Wagner Electric Manufacturing Company
St. Louis, Mo.

The writer has had the privilege of reading over Mr. Layman's reply, and there is little, if anything, that can be added to the statements made by Mr. Layman, as they cover the question thoroughly and coincide with our experience in the use of properly designed single-phase motors and control apparatus in connection with direct-connected elevator installations of moderate capacity and speed requirements, for operation on circuits where frequency does not exceed sixty cycles.

The principal obstacle that we have encountered, and that has prevented a more rapid introduction and more general use of the single-phase direct-connected elevator equipment, has been the difficulty in obtaining proper current supply without excessive drop in voltage at starting, and there are many communities where it would seem a sufficient amount of current could be sold for the operation of single-phase elevators to make it worth while to the central station manager to provide adequate generator and line capacity to overcome this feature, and warrant him in making a drive for this class of business.

Otis Elevator Company
R. W. Charles, Assistant General Sales Manager
New York.

19—44. Will member companies kindly give information relative to aligning shafting for their customers, that is, whether or not they test shafting and report to the customer the condition of the same, or do any other work on shafting?

It is our practise to test the load on customers' motors upon request. The results of the test are entered on a card which gives the following information:

Watts motor free (belt off) (warm or cold) shafting free, average load observed, maximum load observed, minimum load observed,

diameter of shafting, speed of shafting, number of hangers, number of loose pulleys, watts per bearing, number of operators working, useful average watts per operator, name and size of machines driven by motor.

The watts per bearing are compared with average figures (See N. E. L. A. Proceedings 1909, Volume 2, page 625), and if in excess the customer is advised. No work, however, is done toward lining up the shafting.

C. A. Graves

Brooklyn, N. Y.

The Rochester Railway and Light Company does not line up shafting or do other millwright work for its customers. They will, however, determine the transmission losses in any of their customers' installations, and make recommendations as to better lining-up of shafting, regrouping of machines, installations of clutches, etc., where by so doing a saving in cost of power can be effected.

Edward L. Wilder

Rochester, N. Y.

19—46. In the lumbering districts where electric power is used to drive saw mills, are alternating-current motors operated from the line through transformers, or do they install rotary converters and then use direct-current motors?

We are not exactly in a "lumbering district," but we have a customer operating a sawmill with a 40-horse-power, 440-volt, 3-phase induction motor, fed through transformers from our 2200-volt mains, and same gives entire satisfaction.

You probably ask about the use of rotary-converter and direct-current motors thinking it necessary to have variable speed drivers; but while there are such induction motors on the market, I believe, I do not think that sawmills find it very necessary to have other than constant-speed drivers.

A. G. Gibbony, Superintendent

The Massena Electric Light and Power Company

Massena, N. Y.

20—69. We were greatly astonished to be informed by a large manufacturer of meters, that no other central station had ever requested them to increase the size of the registering train dials.

We feel that larger dials would greatly facilitate the reading of meters and reduce errors. If all the central-station managers, who feel as we do, will write the editor of the "Question Box," it may be possible to bring about the desired change. How many would like to see the dials larger?

We find the present wattmeter dials large enough, as we require all meters installed not over six feet from the floor, in an accessible place.

H. B. Williams
North Shore Electric Company
Chicago Heights, Ill.

If it can be done at no expense to the other qualities of the meter it might be well enough. Personally the writer thought the change from the watt-hour dials to kilo-watt hour ones a great improvement.

Bangor Railway and Electric Company
C. M. Tolman, Engineer
Bangor, Me.

The present standard four-circle meter dial was adopted several years ago by the General Electric Company, in response to a request from the Meter Committee of the Association of Edison Illuminating Company for larger dials than were then in use on any of the standard meters. The same dial has since been adopted by a number of manufacturers and would seem to be large enough for the accurate reading of meters.

O. J. Bushnell
Chicago, Ill.

We have never felt the need of meter dials being larger to be more easily read since the new 4-dial styles have come out. The old 5-dial styles were hard to read, but by care in installing, so that no meters are extremely high, and by use of meter readers' flashlights, we experience little difficulty which can be traced to the dials being too small.

A. G. Gibbony, Superintendent
The Massena Electric Light and Power Co.
Massena, N. Y.

20—70. What is the best method of measuring the simultaneous maximum demand for a customer having eight three-wire direct-current meters? The meters are connected from a substation bus, to which other customers are also connected.

(Other replies in December and January BULLETINS.)

The Sangamo Electric Company have accomplished this by connecting together, mechanically, the wattmeter elements of several graphic meters, so that they all actuate the one pen. Their wattmeter can be operated from meter-resistance shunts. Also, the same scheme has been applied to a group of Westinghouse graphic meters.

H. H. Lyon
Buffalo, N. Y.

20—71. Why should a single-phase induction watt-hour meter run 50 per cent slow and creep backward steadily, after a short-circuit on the house line?

A short-circuit on a single-phase induction watt-hour meter would not always cause it to run slow 50 per cent and creep backward, but in a case where this occurred, the cause would undoubtedly be a short-circuiting of the right-hand series coil. This might possibly be brought about by the distorting or charring of series coil, or both, when undergoing short-circuit. Anyone familiar with induction meters knows how the current in the shunt coil would induce a current in this closed circuit which reacts across the air gap and in conjunction with the shunt coil causes a rotating field.

Paul Neill
Newark, N. J.

Provided the meter is of the induction type having one potential and two current coils, the only thing that would cause it to run 50 per cent slow and creep steadily backward after a short-circuit on the line would be a short-circuit in the current coils. That is, the meter is defective and it should not be inferred that a meter would ordinarily perform in this manner after a short-circuit on the line.

F. G. Vaughen
Schenectady, N. Y.

No doubt the short-circuit caused a breakdown in potential coil, cutting out some of the turns of wire. This would cause the meter to run slowly and creep backwards on no load.

H. B. Williams
Chicago Heights, Ill.

An induction meter, with a short-circuited turn or turns in the current coil, will creep backwards at a considerable speed, depending upon the number of turns that are short-circuited. The short-circuit on the house side of the meter has undoubtedly injured the insulation of the current coil in this case.

A. E. Le Fever
Buffalo, N. Y.

If a two-wire meter were in use on a single-phase two-wire circuit which composed one side of a single-phase three-wire distribution system, and if the field coil was connected in the line leading from the system neutral, then any condition producing a flow of current between a point on the line from the system neutral beyond the meter and the outside wire not of the original two-wire circuit, such as a ground, may cause a reduction and possibly a change of direction in the current strength of the wire from neutral. Such a condition may cause a meter to run slow or to reverse according to the extent of the ground.

M. O. Jenkins
New York

20—72. What has been the experience of member companies with polyphase rotating testing standards?

We test all our power meters for balance and test each phase separately, using a single-phase calibrator. The three-phase calibrator is bulky, heavy and inaccurate.

H. B. Williams
Chicago Heights, Ill.

We use a polyphase rotating standard for testing our polyphase integrating meters and same has been entirely satisfactory. The rotating standard is checked about once each month by comparison with precision instruments.

Connecticut River Transmission Company
E. J. Richards, General Superintendent
Fitchburg, Mass.

The Commonwealth Edison Company has been using multiple-field polyphase rotating standards for all line tests of polyphase meters for several years. We have found them very satisfactory and believe this method of testing to be the most accurate and economical for this class of meters.

O. J. Bushnell
Chicago, Ill.

We have not used a polyphase rotating meter for testing, because we do not think the principle is correct, if the meter is to be calibrated. Any polyphase meter should be calibrated as two single-phase meters. The polyphase standard might be used to advantage in simply checking a meter under running load.

H. H. Lyon
The Cataract Power and Conduit Co.
Buffalo, N. Y.

This company has used a Westinghouse polyphase rotating test meter for the past twenty months, and it has proven to be very successful.

Haverhill Electric Company
James E. Frank, Haverhill, Mass.

20—73. Will member companies please state what they find to be the most satisfactory 3-phase demand meter?

There are two very satisfactory instruments for measuring the maximum demand of 3-phase power circuits.

One of these is the General Electric Company's polyphase recording type W. This instrument is accurate on inductive loads, being constructed the same as the regular type D polyphase watt-hour meter. It can be adjusted for any time lag from 5 to 60 minutes by changing the position of the dampening magnets. The demand is indicated in kilowatts on a circular scale in front of the meter.

The other meter is the Chicago Printing Attachment, which can be connected from the dial register of any meter. The actual dial reading is reproduced on a chart at any interval desired.

Both of these types are in use in this city and are giving excellent results.

William Eichert
Foreman M. T. B., Brooklyn, N. Y.

The Westinghouse graphic wattmeter has proven fairly satisfactory with us.

H. H. Lyon
The Cataract Power and Conduit Company
Buffalo, N. Y.

There is no instrument at present on the market which fills the bill in every particular. We have had most satisfaction with the Westinghouse polyphase graphic instrument. The principal faults of these instruments lie in the fact that they require frequent and intelligent care. The pen-points are liable to become stopped up unless watched closely, and the cost is prohibitive on all but comparatively large installations. An instrument which would do the work satisfactorily and still come cheap enough to place on small installations is the crying need at this time.

H. A. Jackson
Tonawanda Power Company
No. Tonawanda, N. Y.

There is no satisfactory three-phase demand indicator. The only device of this kind now on the market is too complicated and too delicate for satisfactory operation under service conditions. It is also quite expensive.

A. D. Spencer
Detroit, Mich.

20—74. On a 3-phase, 60-cycle system it is desired to measure each month the maximum K. V. A. load (not the actual kilowatts) of a customer using induction motors. Whatever instruments are used must have a time lag of perhaps five minutes, as it is not desired to measure either the starting current or any momentary peak.

What is the best means of accomplishing the object in view, and will any circumstances, not ordinarily to be foreseen, give a false reading, either too high or too low?

We have installed graphic wattmeters and graphic power factor meters. If the load is fairly steady and not unbalanced they should prove satisfactory.

H. H. Lyon
The Cataract Power and Conduit Company
Buffalo, N. Y.

I infer that the customer for whom such an installation would be made is a comparatively large one. In such a case the installation of a curve-drawing polyphase wattmeter, and of a curve-drawing power factor indicator properly damped, and the interpretation of their curves with reference to the time element, will accomplish the results desired. The use of maximum-demand current meters for this service is to be deprecated, since these meters penalize the customer in case of low voltage, and since, in case of a short on the line, or an unbalance of line voltage with respect to either phase or magnitude, will cause certain phases of the motor to act as a generator, in part, at least, thereby producing a large current flow to one or more phases. Such a condition might rotate from phase to phase within the period between readings, and thereby indicate a much larger current demand than is properly chargeable to the customer's installation.

John C. Parker

Rochester, N. Y.

The only method which has proved practical is to obtain load curve in K. V. A. by periodic readings or by curve-drawing instrument, and to obtain the desired demand from this curve by observation. Peaks due to starting current, etc., may be omitted.

Another method of obtaining the same result would be by the use of a Chicago Printing Attachment applied to a single-phase ampere-hour meter installed on one wire and calibrated for K. V. A. If the record of the Printing Attachment were made every fifteen minutes, it would be possible to identify and eliminate peaks due to starting current, etc. This method would be correct for balanced three-phase load.

Wright demand indicators may be used (with an assumed voltage) to obtain K. V. A. demand. The only objection to this is the fact that, with rapidly recurring peaks, the reading of the demand indicator will gradually increase and record these peaks.

A. D. Spencer

Detroit, Mich.

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

Two clever Rochester ads. exploiting unusual uses of current. Rochester seems to be "all alive."

If you would keep your store window investment working

Keep the Frost Off the Windows

The simplest, most effective, and cheapest way to accomplish the feat is to place an ELECTRIC FAN in the window.

If you haven't the fan we will gladly send our expert to make a demonstration to prove our statement and submit fan prices.

Phone us

ROCHESTER RAILWAY AND LIGHT CO.

Specific No. 32

Why Suffer?

The physical exhaustion incident to cranking your auto these cold winter mornings when a 32-candle power electric lamp placed under the auto hood will furnish all the heat necessary to keep your engine warm so, cranking will be easy. You owe it to your business to start out right in the morning and you certainly don't start right if you start out physically exhausted and mentally upset by excessive cranking operations.

'PHONE US

We will send an expert to talk it over with you.

Rochester Railway & Light Co.

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

(See November and December BULLETINS for other answers.)

Displays of small electrically operated appliances for the household, neat and attractive electric fixtures and small motor-operated appliances have proven very satisfactory window displays. A demon-

stration of electrically operated appliances on the sales floor has resulted in making many sales to those whose attention was attracted by the window displays.

Ross B. Mateer
Denver, Col.

In the sale of window lighting we have used our own windows to good advantage. We select merchants in different lines of business and have them install a window display. Our representatives then bring merchants in this same line of business to view these windows. Our windows are well illuminated, and we select merchants who will make the display as attractive as possible. This method has resulted in a large number of flat-rate window prospects being closed. In decorating our window with appliances we use some animated object to attract attention, and arrange our appliances in such manner that they will be shown to the best advantage.

J. E. Harsh, Commercial Manager
The Empire District Electric Company
Joplin, Mo.

21—19. What companies send out circular letters to prospective customers? Are these letters prepared by the local advertising manager, or are special advertising agencies employed?

A regular campaign of advertising by the use of personal letters is maintained by our company. Special letters are from time to time prepared and mailed to prospective customers, such letters being signed by our secretary. The letters are prepared under the supervision of our own advertising department.

Ross B. Mateer
Denver, Col.

The Denver Gas and Electric Company sends out both circular and special personal letters to lists of prospective customers. The letters are prepared by the company's advertising manager, in co-operation with representatives of the various territories.

An effort is made to send out letters on different topics at most seasonable and effective times. The lists are taken from files of the advertising department, which are kept up to date by being checked each month with the canvass books of the representatives. These files furnish instantly available information regarding the names, address and total number of prospects of any class.

R. G. Munroe, Service Supervisor
The Denver Gas and Electric Company
Denver, Col.

The General Electric Company, appreciating the value of co-operation with central stations, has prepared at great expense a very complete set of advertising material to be used by the central station for

obtaining new business. This consists of groups of pieces with direct-by-mail letters specially prepared for different kinds of campaigns, such as houses using both gas and electricity, houses unwired, store lighting, etc. This material is available for central-station companies, who are thereby enabled to obtain well-prepared advertising material at practically no expense.

A nominal charge is made which merely represents one-quarter of the cost of the actual printing, and this is simply to insure the sincerity of the central station and prevent waste. This material, furnished with any desired imprint, affords the central station very attractive advertising matter without the expense of an advertising department.

C. W. Bettcher
General Electric Company
Harrison, N. J.

We do very little circular letter work, except in connection with electric signs, in which case the letters are prepared by the sign salesman, and edited by the assistant commercial agent. We consider the local newspapers the best mediums for paving the way for personal calls, and we concentrate our energies along that line, with the exception aforementioned.

J. P. MacSweeney
Rochester, N. Y.

The Brooklyn Company has a follow-up system of mail advertising which includes a number of circular letters. Part of the solicitor's regular work is to turn in three prospects each day to the advertising department, noting as to whether prospect is for residence, store or sign lighting, power, etc. One pamphlet, folder or circular letter is sent to each of these prospects once a week, for a period of six or eight weeks, each piece of matter including a return post-card. The body of the letters is printed and the addresses so carefully matched under our system in vogue as to defy detection. A card record is kept of every piece of advertising sent to every prospect and the returns therefrom, and the system, which has been in operation for a number of years, has proven very effective in securing and aiding to secure new business. All advertising matter is prepared by our advertising manager.

(Miss) E. E. Duffy, Advertising Department
Edison Electric Illuminating Company of Brooklyn
Brooklyn, N. Y.

21—20. How many solicitors should be employed to work a city of 350,000 population, where gas competition is very keen and municipal ownership threatened?

(Replies in January Bulletin from Rochester, Chicago, Minneapolis, Atlanta and Kansas City.)

Local conditions should always govern the number of solicitors required. Under some conditions one solicitor to ten thousand inhabitants would be sufficient; under other conditions, one solicitor to every five thousand inhabitants would be necessary.

Under conditions mentioned in the question, my opinion is that with your population, for the present at least, you should have about fifty solicitors in order to properly care for the competition and to try and prevent municipal ownership.

W. J. Baeder, Vice-President and General Superintendent
The Denver Gas and Electric Company
Denver, Colorado.

It would certainly not be too many solicitors to employ one for every 10,000 of population.

Lloyd Garrison, Representative
Utah Light & Railway Company
Ogden, Utah.

There should be one general lighting solicitor for each 10,000 to 25,000 of the population, depending upon the length of time available for the canvass. This would give from 14 to 35 for this territory, in addition to from 3 to 6 power men, and 2 or 3 sign men. With systematic work, such a force should be able to interview every consumer and non-consumer in from 3 to 9 months, taking time to give each prospect careful attention and follow up prospective business closely, take care of complaints, etc. In case of threatened municipal ownership, I should think the first thing to do would be to gain the good graces of every existing consumer, as far as possible, and then go after the new business.

A. G. Rakestraw
Wilkinsburg, Pa.

It is very difficult to give an intelligent answer as to the number of solicitors you should employ. A better plan would be to consider the percentage of the gross receipts of the company involved that could be profitably spent on new business, and then divide that amount up into soliciting and advertising expense in the ratio that would seem to produce the best results.

The Dayton Lighting Company
Dayton, Ohio.

21—22. What companies offer special wiring inducements for outline lighting of buildings? Do consumers furnish lamps and renewals? Does company furnish man and ladders for renewing lamps?

This company handles outline lighting on its regular sign rates, and we find that we can sometimes induce a man to outline a building who will not put up a sign. This is especially true of small buildings. The consumer must pay for the wiring and the first installation of.

lamps, after which the company furnishes and installs all renewals. Every Saturday two of the men inspect all signs and make the renewals, and really take less time than might be expected.

R. A. Brooks, Secretary
Bristol Gas and Electric Company
Bristol, Tenn.-Va.

The Rochester Railway & Light Company offers no special wiring inducement for outline lighting of buildings, but gives estimates of cost, and secures from contractors figures for the work, or any other information that the consumer may desire in planning or laying out the outlining. The consumer is charged with the first installation of lamps, when purchased from the company, and can renew free all 4 candle-power, 8 candle-power and 16 candle-power lamps at our lamp counter; or, the company will maintain outlining the same as electric signs—½ cent per lamp per month up to 200, and for all over 200, ¼ cent per lamp per month additional. This is for labor only. Where Mazda lamps are used, the charge is the same as above, and the difference in cost between the carbon and Mazda lamps additional.

L. W. Layman
Rochester, N. Y.

We have practically no outlining of buildings, except for special events. The same amount of energy put into an electric sign will be in the end more satisfactory to the customer, and we recommend it in preference to outlining.

A. G. Rakestraw
Wilkinsburg, Pa.

21—24. What effort has been made to stimulate other than regular salesmen to promote the sale of various appliances as well as of the company's product?

The Brooklyn Edison Company has tried two methods of "stimulating" employes, other than those of the sales department in order to increase the sale of electric current and appliances.

The first plan called for volunteers, non-members of the sales department, to be known as special agents, to be authorized to solicit and secure business during their own and not during the company's time, and who should receive compensation in the form of a commission of half the amount of the first month's bill of any new customers so secured. A large number of employes volunteered and were given a course of instruction in the company's contracts and practises. The plan was then given a thorough trial after which it was discontinued as unsatisfactory. It was found that, as motion moves along the line of least resistance, so these special agents, instead of digging up business for themselves, made such arrangements as to be able to secure in many cases advance notice of new installations and people about to become customers. Of course there were exceptions, but the

large majority of the business signed by the special agents was of this class, the net result being that the company paid a commission on business that it would undoubtedly have secured through its regular sales force, and got very little business that would not have been otherwise secured. Another unfortunate result was to induce dissatisfaction and unpleasant feeling among the members of the regular sales department.

In January, 1910, another system of interesting all employes was started. This is called the red book system and has proven very satisfactory indeed.

Every employe of the company who signifies interest or willingness to co-operate is furnished with a small red suggestion book. Each book and each page is numbered. The red book possessor writes any information or suggestions he deems may be of value to the sales department on a leaf of this book and turns it in. The leads so made cover places where new business can be secured or old business held, installations requiring lamp renewals, notifications of defective installations or the necessity for company work of any kind. These leads when turned in to the sales department are recorded, and an accurate account kept of results obtained.

About 300 employes are at present using these books, and the amount of information and business secured through them is exceedingly gratifying. Over 3000 leads were received during 1910, which led directly to the signing of 700 contracts, beside other results, direct and indirect.

When this system was inaugurated it was announced that the men producing the best results would be appropriately rewarded. There was active competition. As a result of the first year's work, the four red book leaders, one from the auditing department and three from the fiscal department, were each awarded $50 in cash.

J. L. Wiltse
Brooklyn, N. Y.

21—25. We would be pleased to know what success some of the member companies are having with the use of the Excess Indicator, recently placed on the market; as to its practical operation, commercial features, its ability to draw new business, and its effect on old customers. We operate in a town of about six thousand, where natural gas is very cheap and it may be possible to obtain some new business with this device, but before taking action we would like to know some experience of others with it, especially in towns of our size.

The following is a list of some of the companies who have established a controlled flat-rate in connection with Mazda lamps and Excess Indicators, and who have offered same to residences:

Dover, N. H.	Twin State Gas & Electric Company.
Concord, N. H.	Concord Electric Company.

Claremont, N. H.	Claremont Power Company.
Berlin, N. H.	Berlin Electric Light Plant.
St. Albans, Vt.	Vermont Power & Manufacturing Company.
Swanton, Vt.	Village Electric Light Plant.
Provincetown, Mass.	Cape Light, Heat & Power Company.
Hartford, Conn.	Hartford Electric Light Company.
Norristown, Pa.	Norristown Electric Light & Power Company.
Hazelton, Pa.	Harwood Electric Company.
Williamsport, Pa.	Lycoming Edison Company.
Harrisburg, Pa.	Harrisburg Light, Heat & Power Company.
Altoona, Pa.	Penn Central Light & Power Company.
Wilmerding, Pa.	United Electric Light Company.
Pittsburg, Pa.	Allegheny Co. Light Company (In Irwin).
New Philadelphia, O.	Tuscarawas Co. Light & Power Company.
Freemont, O.	Freemont Yaryan Company.
E. Liverpool, O., Steubenville, O., and other cities in this syndicate	Ohio Valley Traction & Light Company.
Chicago, Ill.	North Shore Electric Company in Chicago Heights.
Christopher, Ill.	Christopher Electric Company.
Superior, Wis.	Superior Railway, Light & Power Company.
Sheboygan, Wis.	Sheboygan Railway & Light Company.
Marinette, Wis.	Menominee & Marinette Light & Traction Company.
Menominee, Mich.	Menominee & Marinette Light & Traction Company.
Port Huron, Mich.	Port Huron Light & Power Company.

The above companies have obtained results directly in proportion to the amount of effort put in. The best results have been obtained where special men employed by us have made a general canvass for new business.

We have adopted a policy of the introduction of a campaign, the purpose of which is to secure unwired residences to become customers of the local lighting company.

The force of men we employ and who are located locally, comprise a corps of trained solicitors, who are capable of actually going out and getting the new business in face of competition. The work of these men has the approval of the local company and they are under their direction.

The local lighting company advertises the proposition in the newspapers and otherwise.

We, in every case, have found it necessary to lay out a wiring campaign and to secure the endorsement of local contractors. The lighting company advertises the wiring end, in conjunction with the lighting end. The solicitor, therefore, is able to make a contract covering lamps, wiring, fixtures and lighting. In no case is this

wiring done at a loss to the company, and over 75 per cent of all contracts taken pay cash.

The result of these campaigns show the individual record per man as 10 new lighting contracts per week per man employed.

The most interesting records are being obtained at Hazelton, Pa., and Altoona, Pa., for these cities comprise a very cheap population, mostly foreigners of the laboring class. In many cases they own their own homes, but a large number are able to pursuade their landlords to wire. The landlords and the tenants co-operate in order to take advantage of the flat-rate proposition.

We have advocated, and the companies have accepted, a rate of one cent per watt per month. This rate nets the lighting company $120 per kilowatt of customer's maximum demand per year. Mazda lamps are used with this rate exclusively, and the renewal cost of these lamps prevents the abuse of the privilege as far as extending the hours of burning beyond the necessary point.

A careful record has been kept of a number of companies as to the average hours of burning and this record shows that, under no circumstances, will it exceed four hours per day.

The net returns per kilowatt of station capacity are very much higher than they are on an ordinary meter basis. The average income per residence is $20 per year, and this is the same as obtained from metered customers.

All the figures indicate that there is a very large amount of residence business lying dormant in every city and town east of the Mississippi River. This business can be secured by establishing a controlled flat-rate of one cent per watt per month in connection with tungsten lamps, regardless of the form of competition, whether it be artificial gas, natural gas, oil, gasoline, or acetylene. The business, when secured, is as profitable as any central station business possible to obtain.

A. T. Holbrook, General Sales Manager
Excess Indicator Company
New York.

We have not had any experience with the use of excess indicators. Certain features in their operation are attractive to us, but we deem it injudicious to place a barrier against the customer's ability to demand power at any time and as often as he may wish. We believe that the more nearly ideal condition is to educate the customer to avoid peaks, to meter such peaks, if necessary or practicable, but to allow him to make a peak demand and to pay for it if desired.

John C. Parker
Rochester, N. Y.

Last August our company started an excess indicator campaign in this city (population 11,000). To date we have received approximately 100 new customers, besides stimulating new business on the

meter basis. 75 per cent of this business we believe could not have been secured on a meter basis. As a new business getter the indicator has many favorable talking points which appeal to the laboring class and those owning small houses. The up-keep of an indicator is small, practically needs no attention after it is installed, saves meter reading, etc.

J. H. Peterson, Manager New Business Department
Menominee, Mich.

21—26. We are fighting hard to secure the business of our city to operate their water-works by electric current. Will member companies who supply current to water-works help us with data and information which might aid us in getting this business?

The Great Northern Power Company is supplying all of the power used for pumping the water supply for the city.

The water department pays us on a sliding scale at the rate of from $6.50 per million gallons per month for an average of 6,000,000 gallons per day down to $5.50 per million gallons per month, for an average of 15,000,000 per day or over.

The contract provides that pumping must not be done during the hours of our peak load, or from 7 to 9 A. M. and from 4.30 to 8.30 P. M., but if it becomes necessary to pump during these restricted hours, an additional charge of 50 cents per million gallons is paid.

This company delivers current to the city's pumping station at approximately 12,500 volts, 3-phase, 25 cycles, and the entire installation, including transformer, switchboard, motor and pump, was installed by the city.

The pump is rated at 12,000,000 gallons for twenty-four hours, pumping against a static head of 290 feet, and tests made by the city's consulting engineer, showed a maximum efficiency from the incoming transmission line to water, of 73.1 per cent.

Our bills are based upon the readings of the city's water meter, but these are checked by an integrating watt-meter at the pumping station, and our records show that the above rates produce a revenue of $.00461 per kilowatt-hour, which, on the basis of eighteen hours per day, is equivalent to $30.30 per kilowatt-year, on the assumption that the load during eighteen hours is constant, which is the case.

The city purchased the installation, consisting of a 1000 horsepower motor, centrifugal pump, transformer, switchboard, and all equipments, for $16,000, not including cost of installation.

In addition to the installation covered by the above, we are also supplying power for two booster pumps for raising the water from the main system to the high levels of the city. One of these is on a limited hour contract, the other being unlimited as to use, both being based on electrical input, irrespective of the quantity of water handled.

We consider the city's pumping business a valuable asset, our total income during 1910 from this source being $18,470.50.

W. N. Ryerson, General Manager
Great Northern Power Company
Duluth, Minn.

22—36. Should the demand charges of a station be apportioned according to the customer's average maximum demand or to the customer's maximum average demand, or to both; also what is a fair method of apportioning these charges among off-peak consumers?

I disagree with Mr. Hale in his answer to this question. [Mr. Hale's reply was published in the December BULLETIN.—Editor.]

The cost of supplying service to any customer may be divided roughly into the fixed and variable charges, the former in proportion to the amount of station capacity required, the latter in proportion to the amount of current consumed. Now the first item is a factor, not only of the maximum demand, but also of the time at which that demand occurred. It is well known that at certain hours, and seasons, the station capacity is taxed the most, which period we speak of as the peak. Obviously a demand at this time costs the station more than the same demand during the light load period. In the case of a residence we usually assume that the maximum demand will fall on the peak, and apportion the charge accordingly. Where demand indicators are used, however, this may be misleading, for the maximum demand may have been produced by some piece of apparatus such as an iron, which was used in the daytime, and the bill calculated on this basis, would penalize the use of apparatus which we are trying to introduce. For this reason I am in favor of estimating the residence demand on the basis of lights in the living rooms, or as a certain percentage of the connected load, or on some other similar basis. If demand indicators are used the average of monthly readings would serve as a good basis for apportioning the fixed charge. In commercial business, the demand should be fairly steady, and fewer readings may be taken as the basis of an average. In power business, the maximum demand may come on the peak or it may not. This the demand indicator does not show. We should therefore base our calculations on the known hours of operation, or in the case of a fluctuating load, or mixed power and lights, the most accurate method of arriving at the result would be by means of a curve drawing instrument, which would not only show the maximum demand, but the hour at which it occurred, also the amount of the demand during the peak period. It is plain that the peak demand is the only one that calls for additional station capacity, therefore customers whose maximum demand comes off the peak should in justice be charged only according to the demand they make on the station capacity at peak period. It may be true that 97 per cent of the kilowatt hours sold are off the peak, but the only customers affected by the off-

peak concessions are those whose peak demand is small or nothing, and these are but few in proportion to the total number. I should say that it would be profitable for a central station to take this class of business, such as refrigerating machinery, which may be shut down during peak load by agreement, at the variable charge rate only, plus a small fixed charge sufficient to cover meter reading and billing, etc. Similar concessions could be made to amusement parks utilizing machinery which would otherwise be needed only for the winter peak. By encouraging this class of business, a central station may improve the load-factor of the plant, and encourage further use of current in general.

A. G. Rakestraw
Wilkinsburg, Pa.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given?

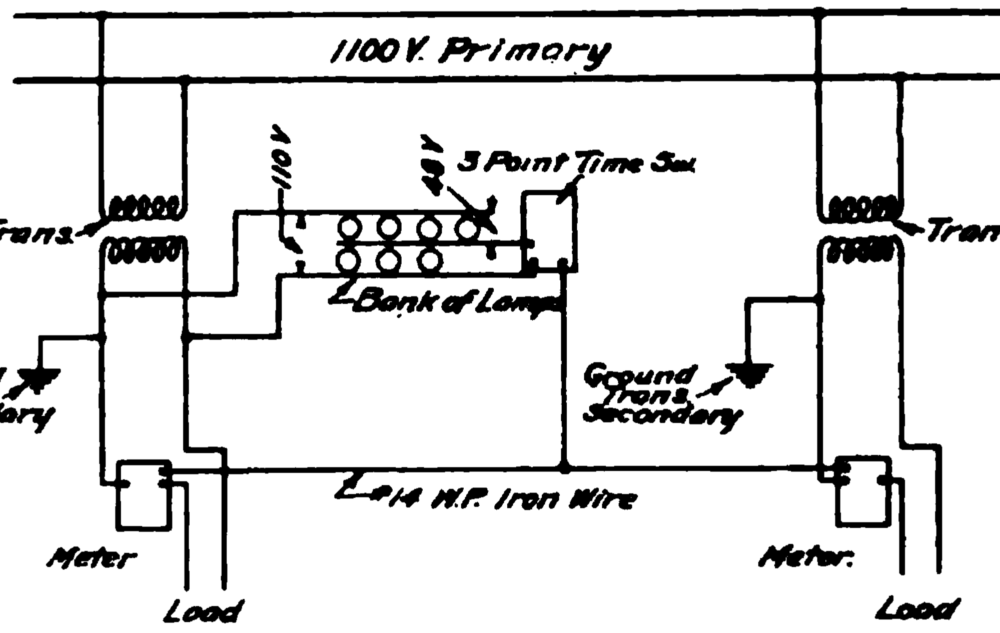
Are there any member companies giving off-peak rates or lower rates for cooking?

(Other replies in December and January BULLETINS.)

We make a special rate for cooking and all other uses, where the customer has installed a complete cooking equipment, as follows:

Months of Nov., Dec. and Jan., 5 P. M. to 9 P. M. ....7 cents
" " Feb. and Oct., 5.30 P. M. to 9.30 P. M. ....7 cents
" " March and Sept., 6 P. M. to 10 P. M. ....7 cents
" " April and August, 6.30 P. M. to 10 P. M. ....7 cents
" " May, June, July, 7 P. M. to 10 P. M. ....7 cents

All hours not included above, 3 cents.



Connections for Meters on Two Rate System

The method of control is simple. Only one meter is used and the registration of this meter is controlled according to the above schedule by applying to the shunt coil only of the meter, either line voltage or a voltage such as to make the meter register three-sevenths of the actual

watt-hours being used. Then by figuring the entire registration of the meter at 7 cents the reduced rate is charged during certain hours.

A 3-point time switch is used to make the changes in the meter shunt connection at the stated hours.

We give herewith a diagram of connections which we used in the two cases where we have applied the scheme. If any great number of such installations were to be made, a special transformer to secure the reduced voltage would practically be necessary instead of the bank of lamps. Also the secondaries of the various transformers might need to be connected in some better manner than through the ground connections.

Our regular rate for residence lighting is a service charge of 35 cents per month plus 7 cents per unit for all current used. We also apply the 35 cents service charge in connection with the two-rate system above explained.

We have found that we can secure an accuracy at least within 3 per cent, from 4 per cent to 100 per cent of full load. We have done no extensive testing, but think it probable that with the light load adjustment set at about 102 per cent for normal voltage, a registration curve at the reduced voltage would run within 2 per cent, from 2 per cent to 100 per cent of full load. The above statements apply to actual and not registered load.

Jefferson Electric Company
Percy Gray, Manager
Jefferson, Iowa.

22—40. What member companies, if any, give a special rate for primary motors (2200 volts), or in what way do they modify their contract for secondary motors (220 volts) in order to take care of this class of service?

Where 2200-volt, three-phase motors are installed and the use of transformers is eliminated, a large consumer is given the benefit of such losses as would ordinarily occur in the transformers. This system is to encourage the use of high-voltage motors.

Ross B. Mateer
Denver, Col.

Taking into account the saving in fixed charges on transformer investment, core losses and copper loss, primary current can be sold to a customer having a load factor of approximately 20 per cent, for about 10 per cent less than secondary current.

C. E. PenDell
Chicago, Ill.

22—41. I have recently built an electric oven with heavily insulated walls to take advantage of the fireless-cooker principle, and fitted it with an automatic temperature-controlling device which seems to stand up and be sufficiently simple to be handled by the average person of the sort into whose hands such an oven would fall in domestic use.

So far as tests now being made indicate, the economy of operation is going to compare very well with that of a gas oven, with the advantage of having the automatic control, this with electricity at even 10 cents per kilowatt-hour.

Can you supply information as to the rates made for current for uses of this kind by the various electric companies? Are special rates made for current thus used? If not, what would be the rates charged in small and large cities?

(For other replies see January BULLETIN.)

I attach herewith a list of central stations, giving their rates for cooking or electric heating. I cannot promise you that this information is accurate. I think it is quite important that such information should be available.

City or Town	Population	Residence Customers	Lighting Rates	Cooking or Heating Rates
Boise, Idaho	11,000	...	$ .15	$ .05-4-3
Walla Walla, Wash. .	13,250	...	.15	.05
Oakland, Cal.	7,400	...	.09	..
Long Beach, Cal.	13,000	...	.06-5-4	..
Sacramento, Cal.	31,000	...	..	.05
Tulare, Cal.	2,400	...	..	.03
Medford, Ore.	1,800	...	.045-4-3	..
San Diego, Cal.	35,000	...	.12	.04
Caldwell, Idaho	1,000	...	.15	.05
Spokane, Wash.	80,000	...	*112.00	*36.00
Denver, Colo.	213,000	...	.10	.04
Blair, Neb.	3,500	350	.20-6	.04
Columbus, Neb.	5,000	500	.20-3¼	..
Lexington, Neb.	2,500	250	.16½	.05
Wymore, Neb.	3,000	250	.16	..
Beatrice, Neb.	12,000	1,000	.13½	..
Duluth, Minn.	67,300	...	..	.02 4/5
Norfolk, Neb.	5,000	300	..	..
Detroit, Mich.	353,500	15,000	.10-2	..
Newark, O.	20,000	500	.09	.05
Piqua, O.	15,000	600	.10	.05
Cleveland, O.	460,500	8,000	.10-2	..
Tipton, Ind.	7,000	600	.08	.03
Connersville, Ind.	8,000	150	.12	.05
Princeton, Ind.	8,000	500	.10	.05
Muncie, Ind.	30,000	1,200	.10	.05
Bloomington, Ind. ...	10,000	750	.10	.06
Bedford, Ind.	8,000	300	.10	.05
Bristol, Tenn.	9,900	850	.12	.06
Johnson City, Tenn. .	12,000	600	.10	.05

*Rate per kilowatt per year.

City or Town	Population	Residence Customers	Lighting Rates	Cooking or Heating Rates
Schenectady, N. Y. ..	70,000	7,000	$ .12	$ .05
Pittsfield, Mass.	30,000	...	.20	.05
Niagara Falls, N. Y. .	30,000	3,000	.09	.03
Hartford, Conn.	159,000	...	.10	.03

H. Mauger, Supply Department
General Electric Co.
Schenectady, N. Y.

22—42. Our city council is beginning to agitate the matter of a reduction of electric light, heat and power rates, and we feel that we should compile a new system of rates. Our present schedule to regular consumers is as follows:

7 K. W. H. to 25 K. W. H........15 cents per K. W. H.
25 K. W. H. to 50 K. W. H........12.5 cents per K. W. H.
50 K. W. H. to 200 K. W. H........10 cents per K. W. H.
200 K. W. H. and over.............. 8 cents per K. W. H.

All large users of power already have special rates and therefore will not be considered in the making up of new rates. Our business houses for the most part close at 6:30 except Saturday evenings and our residence consumers during the past year averaged 14-kilowatt-hours per month.

Our coal costs us on an average of about $2.50 per ton in the boiler room and is a very low grade, in fact, has only about 8,000 to 9,000 B. T. U's. We do not consider present schedule equitable, but it has been in use for the past eight years, and we have been afraid to change it. We do think, however, that the maximum rate should be 15 cents for the first hour's burning with suitable reduction for succeeding hours.

Suggestions or information will be greatly appreciated, especially as to what is the judgment of members as to the most modern and equitable plan for rate-making in the ordinary town of 5,000 inhabitants.

I would call attention to the appendix of the report of the Public Policy Committee, in Volume 2 of the 1910 N. E. L. A. Convention Proceedings. Rates similar to that suggested in the Madison case on page 745 will about fit this case. This suggested rate is as follows:

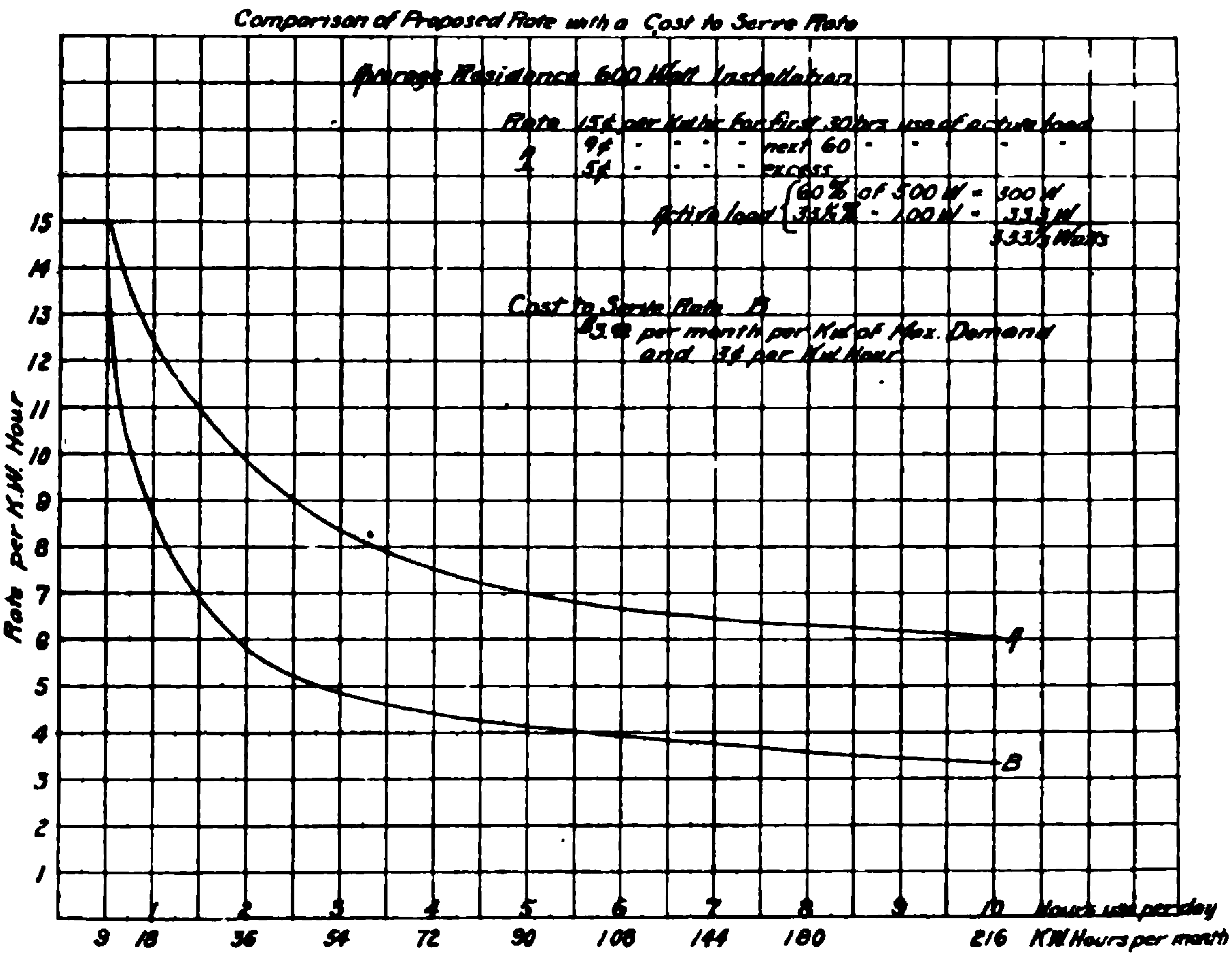
14 cents per kilowatt-hour for first 30 hours' use per month of the active load.

8½ cents per kilowatt-hour for next 60 hours' use per month of the active load.

5 cents for all additional current consumed.

To determine the active load is a problem which will have to be worked out at the town. From page 731 to page 745 will be found an analysis of the method used in the Madison case, which will be an assistance in determining this active load.

Simple methods in use are to base the active load on the number of rooms in the house or on the valuation of the building, or on the square feet of floor space; for residences such rooms as attics, cellars and closets being usually omitted in the count.



As an example of the method of determining the active load used in the Madison case and also the operation of that kind of rate, a curve is given showing the average rate (curve "A") for residences with a connected load of 600-watts, equivalent to an active load of 333 1/3 watts. The rate is that given on the sheet—that is:

15 cents per kilowatt-hour for first 30 hours' use.

9 cents per kilowatt-hour for next 60 hours' use, and 5 cents for all current used in excess of 90 hours' use of the active load.

A curve "B" is also shown which represents the actual cost of supplying current in some small towns with which I am familiar. This curve is based on a fixed charge of $3 per kilowatt of maximum demand per month, and 3 cents per kilowatt hour for all current consumed at the customer's meter.

How near this latter curve represents the cost of the company making inquiry can be determined by them. I believe, however, that it is not far from the cost of the average small station where the capital stock represents actual value and coal costs $2.50 to $3 per ton. It will be seen that there is a good margin of profit between the two curves.

C. A. Graves, Power Engineer

Brooklyn, N. Y.

22—44. When in electrical contracts the term "sunset" is used, lacking a more definite specification, is the solar or standard time supposed to obtain?

Street-lighting tables are necessarily in terms of local mean-time—that is, sun-time; for if in terms of standard time they would only apply to the place or places where the standard time coincides with sun-time, and thus be incorrect for other places within any standard time zone up to a maximum of one hour.

It may be added, as information of general interest, that since street-lighting tables are, for practical reasons, only calculated for one given latitude, they are not strictly correct for other latitudes, and the error increases with divergence from the standard latitude; the disagreement, moreover, varies from day to day for each place differing in latitude, being a maximum at the solstices and zero at the equinoxes. If a table is calculated for 40 degrees latitude, then the maximum variation—which occurs in June and December—for, say, Galveston, Texas, is about 30 minutes. As, however, dusk and dawn, being due to reflected skylight, depend on the condition of sky and thus are indefinite periods, this disagreement is immaterial; in fact, the tables now in use give, not the calculated figure for sunset or sunrise, but assume that daylight in its usual sense ends a half-hour after sunset and begins a half-hour before sunrise. As a single-latitude table occupies, as printed, a large sheet, further refinement in present tables for the United States would be impracticable and perhaps also unnecessary even for the most divergent latitude, owing to the leeway afforded by the indefinite period of dawn and dusk. It may be added that the *Electrical World* each year accompanies its street-lighting tables, issued as a supplement, with an explanation in its columns of the plan of the tables.

W. D. Weaver,
Editor *Electrical World*
New York

"Sunset" is not an arbitrary but a natural phenomenon, and the hour of sunset will vary with a locality within any given standard time zone. The hour of sunset should, therefore, be the solar time at which sunset would be observable. This interpretation is based on the obvious intent of a sunset limitation in any lighting contract.

John C. Parker
Rochester, N. Y.

23—18. What percentage of the total number of customers connected, are disconnected, annually, for non-payment, in companies which have 10,000 customers or more?

(Replies from ten cities in January BULLETIN.)

The percentage of customers of the Brooklyn Edison Company disconnected for non-payment during the year 1910, was 1.52 per cent.

H. W. Cluthe
Brooklyn, N. Y.

About ½ of 1 per cent.

George E. Burns, Assistant to Treasurer
Commonwealth Edison Company
Chicago, Ill.

Three per cent.

R. R. Young, Division Agent
Public Service Electric Co.
Newark, N. J.

The number of customers cut off annually for non-payment of bills, and permanently lost to the company, average about 1.35 per cent.

R. F. Pack, Secretary and Comptroller
The Toronto Electric Light Co., Ltd.
Toronto, Canada.

Approximately nine-tenths of 1 per cent of the discontinuances for non-payment each year are made final.

L. M. Wallace
Boston, Mass.

28—19. What percentage of the total number of contracts with new customers, in companies having 10,000 or more customers, are accepted without a guarantee deposit?

(Replies from eight cities in January BULLETIN.)

A rough percentage of contracts for new customers accepted by the Brooklyn Edison Company, without guarantee deposit, during the year 1910, was 65 per cent.

H. W. Cluthe
Brooklyn, N. Y.

Ninety-six per cent.

George E. Burns, Assistant to Treasurer
Commonwealth Edison Company
Chicago, Ill.

Sixty-four per cent.

R. R. Young, Division Agent
Public Service Electric Co.
Newark, N. J.

Approximately 92 per cent of new business is accepted without guarantee deposit.

L. M. Wallace,
Boston, Mass.

23—20. In power plants from 100-kilowatt to 1000-kilowatt capacities where there have been both a modern steam plant and a gas producer plant, how do the total costs per kilowatt generated compare?

(Also answered in January BULLETIN.)

I do not believe any general answer can be given to this question. The relative cost per kilowatt-hour generated varies with each installation, and with the class of service supplied. In general the fixed charges on a steam operated plant will be considerably less than the fixed charges on a gas producer plant, while the cost of coal per kilowatt-hour generated will be greater for a steam plant than for a gas producer plant. The relative cost then becomes a question of the hours' use per day of the plant, and the load factor on the plant during its operation. The cost of repairs for a gas producer plant is another debatable point on which widely differing figures have been given. Personally, I should not feel like accepting the costs found in any station which has been operated for a given length of time as representing the probable cost in a new station which it is proposed to install, but would consider it necessary to analyze the local conditions very thoroughly, and prepare an estimate based on such analysis. If the conditions under which the given plant had been operated were not practically the same as the conditions under which the new plant was to operate, very misleading results would be arrived at by using such data as a guide.

R. D. DeWolf
Rochester, N. Y.

23—21. Wanted: Information or recent data relative to the cost on which electric companies base their minimum charges. That is, figures giving general information as to the stand-by or investment cost per kilowatt along the lines of, say, one hundred dollars per kilowatt for station equipment, and then certain figures for overhead line construction, and certain other figures for underground construction per kilowatt capacity, etc.

(Also answered in January BULLETIN.)

In re the bases of minimum charges:

Referring to *Finances of Gas and Electric Light and Power Enterprises*, by William D. Marks, we find, on page 162:

MINIMUM CHARGES.

The minimum charge per lamp per year should be:

$z\frac{C}{N}$ plus $F = \$2.50$ plus $\$1.46 = \$3.96$ to obtain 15 per cent profit if discounts are made on long hours' use of current.

FORMULA OF COSTS.

Let C = cash cost of the plant (say, $2,000,000).

Let N = number of incandescent 16-cp, 110-volt lamps (say, 120,000).

Let z = percentage of profit desired on the investment (say, 15 per cent).

Let F = the fixed annual charges per lamp (about 6.6 per cent of $\frac{C}{N}$ ($1.46 taken).

In accordance with the foregoing, the minimum per lamp based on a fixed annual charge would be $1.46 per year.

Also at a cost of $2,000,000, we have a capacity for 120,000 lamps, or 6000 kilowatts, which at a cost of $2,000,000, gives approximately $333 per kilowatt for investment costs.

Note that one of the main features is the fixed annual charge per lamp, namely: $1.46 per year, which would be the basis for a minimum charge where consumer wants the connection maintained but does not use the service.

Another interesting contribution to the subject was made by Mr. H. B. Gear, of Chicago, in his paper, *An Analysis of Diversity Factors*, presented before the Edison Convention, Frontenac, Thousand Islands, N. Y., 1910. I quote:

"The effect of diversity factors on investment. It is of course impossible to make figures which will be applicable to all systems, but from assumptions which represent average conditions in a large system, deductions can be drawn which will serve to illustrate the effect of diversity factors on investment accounts.

"Assuming that the generating plant can be installed for $100 per kilowatt of rated capacity, substation and transmission lines for $60 per kilowatt, feeders, mains, services, etc., at an average of $150 per kilowatt and that meters cost an average of $10 each, the investment required to serve a group of residence lighting customers is $440 per kilowatt of generating station load. Of this amount $124 per kilowatt is for consumers' meters, $11 for transformers, $146 for distributing lines, $58 for substation and transmission lines, and $100 for generating capacity."

Still another contribution on this subject is found in a book called *Data*, published in Chicago, a sort of loose-leaf arrangement for card index filing. On page 17 the investment per kilowatt for various consumers is given with the following total investment costs.

For residence lighting	$440.00
For commercial lighting	354.00
For motor service	330.00
For large users	215.00

They then have this sub-divided, for example:

COMMERCIAL LIGHTING

Meters	$38.00
Transformers	12.00
Distributing lines	146.00
Substation and transmission	58.00
Generating equipment	100.00

These figures all have an important bearing on the subject matter of this question.

Joseph D. Israel
Philadelphia, Pa.

23—22. What is the best method of keeping customers' accounts, by cards or loose-leaf ledger, and why?

Loose-leaf ledger system. The records are more complete and are not so liable to be destroyed.

Ross B. Mateer,
Denver, Colorado.

I have found the card ledger the best method of keeping accounts for the following reasons:

1. It eliminates the high desk and occupies less room.
2. It gives greater ease in reference, because it is self-indexing and contains no dead or blank accounts.
3. It makes possible classification of every kind of account.
4. It affords greater facilities for posting and making out statements.
5. It saves time and physical effort.
6. It is more convenient in adding new or transferring old accounts.
7. It is also an alphabetical record of P. & L. and former customers, which is a great help to credit man to look up before approving credit.
8. In the Brooklyn Edison Company, it is more uniform and works in more perfect harmony with all other records pertaining to any one account which may emanate from other departments of our company.

F. J. McCormack
Brooklyn, N. Y.

The method employed by this company is the loose-leaf ledger system and the principal advantage of this system over a card system is that the accounts are all securely fastened in a binder.

I am of the opinion that the card system is much more rapid, but at the same time we must consider that the possibilities of losing customers' cards are greatly multiplied over that of the loose-leaf ledger system.

E. J. Bowers
Kansas City, Mo.

28—28. A member company is anxious to have statistics showing the percentage of bills uncollectable of the different companies. As this is a matter on which a general symposium would be of value, companies are requested to contribute information on the subject.

Experience of The Philadelphia Electric Company for the past two years shows that the percentage of their bills uncollectable amounts to about one-fourth of one per cent.

Joseph D. Israel
Philadelphia, Pa.

About 30 per cent of our patrons have deposits with the company, or their responsibility has been well established. This, together with our system of collecting, enables us to show the following very low percentage of electric bills charged off as uncollectable bills:

Year 1908	.30 per cent
" 1909	.23 "
" 1910	.19 "
Average	.24 per cent

E. S. Bellows, Treasurer
Westchester Lighting Company
Mount Vernon, N. Y.

The uncollectable bills of this company for the year 1910 are about ½ of 1 per cent of the bills rendered.

H. M. Edwards, Auditor
New York Edison Co.

The total accounts charged off to bad debts in this company are approximately ½ of 1 per cent of our gross revenue.

E. J. Bowers, General Accountant
Kansas City Electric Light Co.
Kansas City, Mo.

In our company the percentage of bills uncollectable amounts to slightly under ½ of 1 per cent.

G. E. Burns, Assistant Treasurer
Commonwealth Edison Co.
Chicago, Ill.

During the year 1910 our bills uncollectable amounted to one-ninth of one per cent.

J. M. Mulvihill, Chief Clerk
Denver Gas & Electric Co.
Denver, Colo.

The percentage of uncollectable bills that we have had during the past three years is as follows:

GAS BILLS:

1908	.0044
1909	.0045
1910	.0026

ELECTRIC BILLS:

1908	.00095
1909	.00099
1910	.00071

MISCELLANEOUS OR APPLIANCE BILLS:

1908	.0016
1909	.0014
1910	.0022

The reason that the percentage on our miscellaneous uncollectable accounts is larger for the year 1910 than for the previous two years, is due to the fact that a few of our customers to whom we had sold electric signs went into bankruptcy.

The average percentage of all uncollectable bills for the past three years—gas, electric and appliance—is as follows:

1908	.0022
1909	.0023
1910	.0016

W. T. Nolan, Chief Clerk
Rochester, N. Y.

Taking an average of nine years, our loss in this respect amounts to approximately 0.25 or ¼ of 1 per cent per annum.

H. R. Lyons
Montreal, Can.

This company has a general average of .216 per cent.

E. J. Allegaert
Public Service Electric Company,
Newark, N. J.

23—24. In companies of 10,000 customers or more, how soon after a customer pays his bill is the amount posted to his account; also, is there any period during the month in which posting payments is delayed and allowed to accumulate, when taking off the balances, etc., and, if so, what is the maximum number of days?

The Philadelphia Electric Company posts all payments made, in from one to five hours after received by the cashier.

Joseph D. Israel
Philadelphia, Pa.

It is advisable, and following the best practice, to post the cash received from customers to the credit of their accounts in the ledger as soon as possible, in any case not later than the next day. The ledger is a record of the state of customers' accounts, and as at any time it may be necessary to refer to this record, it is of the greatest importance that it should from day to day show accurately the exact state of affairs.

R. F. Pack, Secretary and Comptroller
The Toronto Electric Light Co., Ltd.
Toronto, Canada.

Customers paying bills before 2 P. M. daily at our district offices, the cash is posted to their credit by bookkeepers before 10 A. M. the following day. This part of the routine we carry on throughout the entire year—the only exceptions being legal holidays and Sundays—and there is no period during any month when the posting of payments is delayed and allowed to accumulate.

E. S. Bellows, Treasurer
Westchester Lighting Company
Mount Vernon, N. Y.

Our cash receipts are listed up to noon of each day and cash so received is posted by the bookkeepers to the credit of the customer's lighting account before four o'clock of that day. There are no exceptions to this rule. After the cash is posted the following day's collection routes are checked and prepared.

The collection bureau is absolutely dependent on the bookkeeping department for the correctness of its records and no customer is approached for payment except on data furnished by the bookkeeper.

We cannot conceive of a system of accounting which would permit of delay in posting remittances to the credit of the customer's account.

H. M. Edwards, Auditor
New York Edison Co.

The coupon system of handling customers' cash is in use by this company and to my knowledge, is the one generally employed by public utility corporations.

When payments are made on the first day of the month, the cashier turns all of the coupons over to the customers' accounts department on the morning of the second day. They are then segregated by divisions and districts and posted to the customers' accounts on the afternoon of the same day they are received by customers' accounts department.

The only exception to this rule is on our discount date. The posting of the coupons is then delayed an extra day on account of the large number of coupons received.

We do not in any way defer the posting of cash by taking off

customers' ledger balances, as they are made up at a time when the cash receipts are very light.

E. J. Bowers
Kansas City, Mo.

All cash coupons taken in up to three o'clock each day are counted and listed and sent to the bookkeeper between 4.30 and 5.30, and posted each morning regardless of balances or any other interruptions.

C. G. Keeler, Head Bookkeeper
Denver Gas & Electric Co.
Denver, Colo.

Our cash is posted on the account of the customer on the day following its receipt in the cashier's office, with the exception of cases where payments have been made in the outlying districts at drug stores or branch agents of the American Express Company, whose service we employ. The posting of payments made to these agents is delayed in some cases from four to six days. There is no period during the month, in which posting of payments is delayed and allowed to accumulate, for the purpose of closing up the previous month's business.

Geo. E. Burns, Assistant Treasurer
Commonwealth Edison Co.
Chicago, Ill.

We have about 7,500 electric consumers and very nearly 51,000 gas consumers.

The day following that on which payment is made the amount is posted on our customers' accounts, excepting during the first two days of the month, when our bookkeepers are taking off balances, etc. Two days is the maximum number of days in any month during the past two years that our tickets have remained unposted. Usually they are only left over for one day, for we have our readings all entered and bills ready to be delivered on the 29th or 30th of every month, and the delivery is always completed on or before the 7th of the month.

W. T. Nolan, Chief Clerk
Rochester Railway & Light Co.
Rochester, N. Y.

Receipts posted to customers' accounts same day as received. No exception to this rule.

L. M. Wallace,
Boston, Mass.

All amounts received by our cashiers and collectors are transmitted to our ledger keepers and credited to the various customers' accounts in the ledgers upon the same day as they are received. This practise is carried out every working day in the year, as our system of

collection will not permit of any coupons being withheld until the following day.

H. B. Lyons,
Montreal, Can.

All payments made by customers are posted the day following the receipt of same; cash account is closed for the month at twelve o'clock noon the last day of the month; the first cash to be received by bookkeeper is on the second day of the month and embraces all payments received from twelve o'clock noon of the last day of the month, up to 5.30 o'clock P. M. of the first day of the succeeding month; there is a delay in posting of one day under this arrangement and no postings are allowed to accumulate longer than this.

E. J. Allegaert
Public Service Electric Company,
Newark, N. J.

24—82. We would like to hear from member companies as to their policy and practise in supplying breakdown connections.

(See November BULLETIN for other answers.)

Our break-down service rate provides essentially for our regular rates, subject to a guaranteed annual revenue of $30.00 per kilowatt per year, service to be controlled by an automatic switch which is set to carry only the capacity contracted for.

B. W. Mendenhall
Salt Lake City, Utah

This company supplies breakdown connections by charging regular minimum for service connected.

J. E. Harsh
The Empire District Electric Co.
Joplin, Mo.

We furnish service on a meter basis at our standard rates for a period of not less than one year, with a minimum monthly guarantee of ten cents per 50-watt lamp, or equivalent thereof—this we term emergency, or throw-over, service—used in conjunction with an isolated plant.

John G. Learned
Chicago, Ill.

24—88. (a) Is there any member company that does not bond its collectors?

(b) On what basis do member companies bond their collectors, i. e., a uniform bond for all collectors, or does bond vary in accordance with conditions of collector's territory?

(c) Do member companies pay for bonding collectors, or are collectors required to pay their own bond premiums?

(d) Do member companies in which collectors are bonded turn the cases over to bond company to settle in case of collector defaulting,

or do they settle cases themselves, notwithstanding the fact that collectors are bonded?

(e) Do any member companies have their own bonding fund?

(f) What do member companies that do not have collectors bonded do if collectors should default?

(g) In last ten years how many collectors have defaulted?

(See December BULLETIN for answers from New York, Chicago, Philadelphia and Kansas City.)

(a) We bond all our collectors.

(b) A uniform bond of $500 is required for all collectors.

(c) The company assumes all charges for bonding collectors.

(d) We have never had a case of default on the part of our collectors.

(e) The company has never adopted its own bonding fund.

(f) We have no cases of this kind.

(g) None.

C. S. Jennings
Rochester, N. Y.

(a) The practise of this company is to bond all employes who handle cash. This includes collectors, tellers, paymasters, etc.

(b) Collectors are all bonded in a uniform amount. The bond does not vary in accordance with the conditions of territory.

(c) This company pays the premium on all bonds issued on its employes.

(d) This is largely a matter of organization and policy. It is the custom of this company to work in conjunction with the bonding companies.

(e) This company bonds its employes through local surety companies.

(g) Our records show that there have been two defalcations in the last ten years.

John L. Bailey, Treasurer
Consolidated Gas, Electric Light & Power Company of Baltimore
Baltimore, Md.

24—25. How many credit men does it require to handle the total business of a company with 10,000 or more customers, and what is the method of passing on this credit?

(See January BULLETIN for other answers.)

The Brooklyn Edison Company employs the district plan in relation to customers. There are twelve districts, with twelve district clerks, who handle about 2200 customers each. These district clerks are responsible for credit, issuance and execution of orders, records, meter reading, billing, bookkeeping, collections, complaints; also make inspections, connections and disconnections of premises, and supply

general information required by the sales and other departments, concerning customers and their accounts. The method of passing on the credit is determined from the information furnished by the salesmen, commercial agencies, the applicant's references, etc. Guarantee deposits covering approximately two months' usage are required where the risk would warrant same.

H. W. Cluthe
Brooklyn, N. Y.

One credit man, if engaged on credit work exclusively, should be able to handle not only the business of a company with 10,000, but even up to 30,000 or 40,000 customers.

The method depends on the policy adopted by the company. The nature of a customer's business, his financial standing and reputation for making prompt payments, are the essential points considered in passing on credits.

George E. Burns, Assistant to Treasurer
Commonwealth Edison Company
Chicago, Ill.

One man for deposit, reference or security.

R. R. Young, Division Agent
Public Service Electric Company
Newark, N. J.

The superintendent of collections (who is also credit clerk) is responsible for the functions of the credit and collection department under the direction of the auditor. Customers' credit is passed on by the credit clerk with the aid of two assistants—chief and junior clerk.

Former customers applying for electric service are accepted with or without guarantee deposit, in accordance with the customer's previous record.

New business is accepted with or without guarantee deposit according to the applicant's business standing or rating as disclosed by local credit book, *Bradstreet's* or *Dun's*.

Deposits to secure prompt payment are, however, required only when necessary, and in lieu of deposit, personal gurantee of some responsible party is occasionally accepted, and weekly bills sometimes resorted to, with or without deposit, depending entirely upon circumstances and conditions in connection with each individual case. Interest at the rate of 4 per cent per annum is paid on deposits and in many instances deposits are voluntarily returned when customer's credit has been established.

The superintendent of collections, with the aid of one chief and twelve regular and two special collectors, is responsible for the collection of bills.

L. M. Wallace,
Boston, Mass.

24—36. What is the best policy for central stations as regards the renewing of tungsten lamps, also at what price should they be sold? By this we mean, whether they are to be sold at list prices, net prices, or should they be replaced free when burned out. This should apply to stations of our size. Our city has a population of about 28,000 with a station capacity of 1500 kilowatts. Our present practise is to have all meter customers purchase their first installation of carbon lamps at $2.50 per dozen. After that, we renew the carbon filament lamps free when they are returned burned out, to our office. Tantalum lamps and Gem lamps we renew for 25 cents less than the list prices. Tungsten lamps we do not renew at all, but sell them at list prices. Also would it be better to raise our rates one or two cents per kilowatt-hour and then furnish free tungsten lamp renewals. Our rates for residence lighting average from 12 cents to 7½ cents net.

(Other replies in December and January BULLETINS.)

As you are now furnishing free renewals of carbon lamps the cost of which is taken account of in your rates, is it not fair to your customers that you should sell them tungsten lamps at a price which represents the difference in the cost of a carbon lamp and a tungsten lamp plus a fair allowance for the accidental loss in tungsten lamps in handling during shipment and otherwise? In other words, you can afford to let your customers have renewals of tungstens at about 10 cents less than they cost you.

If it is desired to hold the issuance of 25-watt lamps somewhat in check, the charge made for these lamps may be made approximately what they cost you. This arrangement is fair to your customers and does not increase your expense for lamp renewals.

It is not advisable to raise rates nor to furnish free tungsten renewals, first, because the customer will not be careful of the lamp if he does not have to pay for it and accidental breakage will therefore be increased; second, because a great many customers will not care to use tungsten lamps throughout and by raising rates you would be charging them a higher rate on the portion of their consumption which is used through fan motors, flat irons and other miscellaneous devices which are usually attached to lighting meters; third, because any attempt to raise rates is sure to make your company unpopular with the public and cause a feeling of harmful distrust in the public mind.

H. B. Gear
Chicago, Ill.

24—41. Wanted: Data regarding the results of ice-making as a side line by electric light and power companies in the United States. It has been advocated as a good means of utilizing power during the hours of daylight, and this is very important to companies using water power.

(Also answered in January BULLETIN. The following replies also answer new question No. 24—48 in this issue.)

Our experience has been that with a small 25-ton ice plant which is not arranged for very economical operation, we are consuming approximately 90 horse-power hours per ton of ice made, but this figure includes the refrigeration of four large storage rooms. Our results show that after paying interest on the investment and operating expenses other than current, the net from operation has given us a net rate of approximately 1½ cents per kilowatt-hour for the power consumed, our ice being sold at $3.00 per ton at our plant.

M. R. Bump, General Manager
The Empire District Electric Co.
Joplin, Mo.

We find ice-making as a side line very profitable. It not only gives more profit from the plant but it makes possible a day circuit in a small town that would not pay otherwise.

John T. McDonald, President
The Jefferson Ice, Light & Power Co.
Jefferson, Texas.

Regarding the results of ice-making as a side line by electric light and power companies, we as a small company, consider it a profitable business as a side line.

As we have a certain amount of fixed expense in our electric light plant, the cost of making ice is but very little more. This cost could be reduced still more if we were in position to use exhaust steam instead of live steam for making our ice.

During the summer months our electric light earnings fall off very materially, but the ice plant earnings are sufficient to keep our total earnings about the same all the year around.

I have not had any experience with water-power plants, but I should think ice-making as a side line in such a plant would be even more profitable than in a steam plant.

Walter King, Superintendent
Williamson Light & Ice Co.
Williamson, W. Va.

Descriptions of combination central station and ice-making plants have during the past year appeared as follows in the *Electrical World:*

Hillsboro, Ill., March 3, 1910; Holdredge, Neb., April 7; Noblesville, Ind., May 5; Loveland, O., August 4; Sterling, Col., August 4. Several general articles on central station ice-making auxiliaries appear in the issue of March 3, 1910. The *Electrical World* will shortly publish the result of a canvass of central stations having ice-making auxiliaries, data having been obtained from more than 100 central stations thus equipped. An indication of progress in this line is given by

returns from Oklahoma, where there are ice-making plants connected with the central stations at Ada, Atoka, Checotah, Coalgate, Haileyville, Holdenville, Hugo, Muskogee, Okmulgee, Pryor and Vinita. A successful combination plant is operated at Williamson, W. Va., by the Williamson Light & Ice Company.

W. D. Weaver, Editor
Electrical World
New York.

In my opinion this matter has two very important sides.

Were I in a town of sufficient size that an electric light plant would have a good load at all seasons of the year, I would not want a combined light and ice plant any more than if I had a grocery store and would consider adding dry goods because I had the house and clerks.

A dry goods business and a grocery store are both merchandising but call for different means and methods if successfully and economically handled.

An electric light plant and an ice factory are both manufacturers and call for engineers, firemen, etc., but they are different in product and sale and each calls for a good man in his respective line and I have found it almost impossible to find an engineer or manager who was good in both lines. For this reason I see no more reason for electric light plants to make ice as a side line any more than they would cotton gins, oil mills or cotton factories unless located in a town so small that the gross business of a light plant alone would not make ends meet.

We started years ago under these conditions and have never seen fit to separate our plants as they started under one roof and have grown up under these conditions.

This is a day of specialty and I think where an electric light plant is in a town of sufficient size they had best stick to that line and make it known for its success in that way rather than to add anything else as a by-product, for nothing good comes from a venture without additional expense and effort.

Sam C. Trimble, President
Orange Ice, Light & Water Co.
Orange, Texas.

I have only recently taken charge as manager and am unable to give complete information, but I am informed that this plant when properly handled has been a well-paying proposition.

Camden Water, Light & Ice Company
L. S. Baxter, Manager
Camden, S. C.

We are operating a 15-ton ice plant in connection with our light and power plant, also a bottling works and a creamery, all under the same roof, and find that the combination works well. We have plenty

of power to run the entire outfit night and day. We are manufacturing as fine ice as is made in the United States, and we consider the combination a success.

Haskell Power Co.
F. M. Morton, President
Haskell, Texas.

For four years we have been making 10 to 12 tons of ice per 24 hours and have thought it more economical to make it in connection with our light and heat plant than in any other way. So far it is very satisfactory. We furnish light, steam, heat and ice. Our greatest trouble has been with the shortage in water. This we bring in by pipe line nearly two miles. Our ice part makes us more than our heating plant. Plenty of water makes ice-making easy and profitable providing you have a market for the ice.

J. N. Hairgrove, President
Virden Light, Heat & Ice Co.
Virden, Ill.

There is no better combination than electric light and ice.

D. Padrick, Manager
Sallisaw Ice & Fuel Company
Sallisaw, Okla.

We are operating in connection with our electric light plant a 25-ton York compression ice machine. We find this is a very good side line as we are using our electric engineers to look after the ice plant. and also the firemen to take care of the same boilers, and therefore, naturally cut down the cost of manufacturing ice. We are, however, not familiar with the conditions existing at the plant of your inquiring member, but think if he has sale for the ice he will find it an excellent side line.

The Sumter Ice, Light & Power Co.
F. A. Bultman, Secretary and Treasurer
Sumter, S. C.

The conditions vary in different central stations; what would be profitable to one station may not be so to another. Ice-making is a good means of utilizing power during the hours of daylight, but to make it economically it must be a continued power both day and night. It also requires plenty of good cool water for ammonia condensers. This will keep the high pressure down, which means a great saving in power, which means a saving of coal.

The conditions in our station were favorable inasmuch as we were running non-condensing engines, hence all exhaust steam went to waste after leaving the water heater. This or a large portion of it we now utilize for ice, as ours is a distilling system.

We wholesaled our ice the last year at $2.50 per ton and had very

ready sale notwithstanding our town is small and we have opposition in the natural ice company, but they do not annoy us very much even if they stand ready to send ice to our town free to dealer or agent.

Under the condition we are making our ice, it only required one additional man to do the work and we have quite a large storage room cooled by brine pipes, and in the fall when trade begins to fall off we fill this room and this enables us to close down for two or three months during winter.

If parties seeking information could call we could show and explain to them far better than writing.

The Bernards Water Company
E. Van Arsdale, Superintendent
Bernardsville, N. J.

In connection with our lighting plant we also operate a 40-ton ice plant. It is just as important to consider the local conditions and needs for an ice plant as though it were to be installed separately, but we find that it is a great deal more economical to operate the two combined, as in this manner we have a balanced load the year round, as during the peak of our lighting load, which is in winter time, our ice business of course is the lightest. The saving on labor in the ice plant is 50 per cent, as the same engineer can manage both, and the same is also true as to fireman. As a matter of fact, the only extra man we require is the man that works on the tank. At the time of the year when it is not necessary to run your ice plant 24 hours you can also balance your load very nicely.

As to advisability of installing electric driven compressors, this depends upon local conditions. It is not practicable to use steam for ice-making taken from engines running condensing, as it is very difficult to separate the cylider oil from the water and purify it for ice purposes, but if the plant in question is running non-condensing, I would certainly drive the compressor with electric motor.

W. E. Sweezey
Union Light & Power Co.
Junction City, Kansas.

24—42. What is considered a reasonable amount of money for a central station to spend on soliciting and developing new business, based upon the gross earnings of the company?

I have seen the statement made that some companies spend as high as five per cent of their annual gross earnings for this purpose. Of course, each company would require to treat this matter in the light of their own needs and conditions, but in a general way, what is the largest percentage that companies spend for this purpose, and what is the average percentage spent by the principal progressive American central stations?

The proper amount of money to be spent by a central station upon soliciting and developing new business varies so with local conditions that any answer to the question of what this amount should be must of necessity be general. In at least two papers which have been presented in the last five years, one before the Association of Edison Illuminating Companies and the other before the National Electric Light Association, this subject was touched upon. The figures given in these papers were obtained from answers given by the member companies to this same question. Soliciting expenses varied from 1 to 2 per cent of the gross revenue, exclusive of railway and municipal business; advertising expenses varied from 1 to 2½ per cent of the gross revenue, sometimes running as high as 3 per cent. By combining these expenses, we find that a fair expenditure for soliciting and developing new business would vary from 2 per cent of the gross revenue, exclusive of railway and municipal business, as a minimum, to 4½ per cent as a maximum.

H. K. Mehr
Philadelphia, Pa.

We spend 5 per cent. This company being a combination company this 5 per cent does not include all that would be necessary for us to spend, providing we were solely an electrical company.

Rochester Railway and Light Company
Karl A. Scheck, Commercial Agent
Rochester, N. Y.

It is generally considered that two per cent. of the gross income is not an unreasonable amount to spend for soliciting for new business and advertising. If the conditions are such that the income per inhabitant in any community is small, the company could well afford to expend more than this amount until they had brought their income to a normal basis.

E. W. Lloyd
Chicago, Ill.

I am of the opinion that a reasonable amount of money spent to develop any business should not be based on gross earnings of the company, as that has very little to do with the cost of developing business. The question should be, "How much of our increase gross income can we afford to spend for developing business?" This matter has been discussed considerably during the last five years, and there is still difference of opinion regarding it. The opinions vary—from that we can afford to spend all of our increased gross for the first year to 25 per cent of the increased gross for the first year. This, however, is a matter that must be looked at broadly for the reason that development work in any one year will have considerable effect on the following year's business, as any impetus that the business receives will be carried along for a certain time even if development work should cease.

Therefore, a reasonable amount of money in one city may be entirely inadequate in another. It is also true that a proportion of the money spent for developing business is really spent to take care of existing business. It is therefore necessary to discriminate between taking care of our existing business and developing strictly new business. This is a very difficult matter to do, for the reason that a well satisfied customer helps us materially to get additional business. Then again, the question of how well the business in a town is developed has a material bearing on this question. Take for an illustration a city that has gross earnings of $10 per capita, it would be more difficult to increase that to $11 per capita than it would to make an increase of $1 per capita in a city where the gross was $4.

H. J. Gille
Minneapolis, Minn.

I do not consider five per cent of a company's gross earnings, devoted to securing new business, excessive. A company could easily spend from three to five per cent for the retaining of old and the securing of new business, the amount thus spent to be determined by local conditions. Some companies spend large sums to secure new business and all agree it is a profitable investment when for every dollar spent the first year a return of from two to three dollars is received.

W. J. Baeder, Vice-President and General Superintendent
The Denver Gas & Electric Company
Denver, Colo.

We are spending approximately two and one-half per cent of our gross receipts and believe that three per cent would be entirely satisfactory.

The Dayton Lighting Company
Dayton, Ohio.

24—44. What has been the experience of member companies in promoting, in a systematic manner, suggestions from various employes?

The Philadelphia Electric Company some months ago established a suggestion system whereby prizes were offered to employes for helpful ideas. This is in the form of a monthly competition with a first prize of $5; second prize of $3; third prize of $2, the judges being a committee appointed by the chairman of the N. E. L. A. Company Section. Boxes for the receipt of these suggestions are located at the various offices and stations of the company. These are emptied out the first of each month and the suggestions submitted passed on not later than the 15th. Since instituting this system a considerable number of valuable suggestions have been received, prizes awarded and the ideas conveyed adopted into practises and policies of the company.

Joseph D. Israel
Philadelphia, Pa.

Towards the latter end of 1908 employes of this company were notified of the adoption of a system whereby suggestions from employes would be received, and if considered meritorious, adopted and paid for at the rate of $10 each. It was intimated that personal criticisms were deprecated, the desideratum being suggestions calculated to improve the methods and increase the business getting and handling efficiency of the company.

The results of this announcement were such that in a short time the following complete system for taking care of the suggestions received and utilizing them to the best advantage was evolved:

Suggestions as received are acknowledged and then sent to each member of the Staff Council of the company (composed of the officers of the company and the 10 heads of departments). A printed form attached to each has space for the opinion of the member, as to the merits or defects of the suggestion, and whether in his judgment it merits an award. These must be promptly filled in and returned to the chairman of the Suggestion Committee, which is composed of three members of the Staff Council.

This committee gives careful consideration to each suggestion and to the opinions of the members of the Council, attaching special weight to the judgment of the head of the department affected. Awards are then made and announced once a month. In case award is not satisfactory to any member of the Council, appeal can be taken to the full Council, which meets weekly.

Beginning January 1, 1910, the awards given to suggestions were graded; $10 for a suggestion of the first class; $5 for a suggestion of the second class; and $2.50 for a suggestion of the third class. There is no limit set to the number of awards which may be made in any one month.

During 1908, 16 suggestions were received and $60 awarded; in 1909, 98 suggestions, and $90 awarded. During 1910, 350 suggestions were received and considered, and awards amounting to $172.50 were divided.

The suggestions received cover practically all departments and phases of the company's activities.

After an experience of over two years with this system, it is felt that it has been of advantage to the company, and that the results have justified the expenditure in time and money.

W. W. Freeman

Brooklyn, N. Y.

24—45. What member companies have discontinued the free sign proposition? Please state reasons.

This company offered its customers a free sign proposition for several years, at one time having more than 1,000 such signs on the system. This business was practically killed by the passage of a city sign ordinance under which the majority of signs erected on customers'

premises but owned by the company had to be taken in because projecting an illegal distance from the building line. The free sign proposition was then discontinued. Better results have followed the present system, under which the customer supplies and installs his own sign, and the company lights it for a flat rate of so much per lamp per year, 365 days' service, between dusk and midnight, furnishing free lamps and renewals.

P. R. Atkinson, Treasurer
Edison Electric Illuminating Co. of Brooklyn
Brooklyn, N. Y.

25—8. If an electric light company supplies current to a defective installation and a fire results, is the company in any way responsible? Will the installation of safe but unapproved wiring in a building vitiate any insurance that may be in force or increase the premium?

(See December BULLETIN for other replies.)

Any company that makes a service connection to a known defective wiring installation would be morally and financially liable for injury or fire.

No wiring can be considered safe without the approval of competent inspectors. Company would be liable if connection were made without such approval.

T. H. Yawger
Rochester, N. Y.

Question 25—8 contains two different questions, which I will answer in their order:

FIRST. If an electric light company supplies current to a defective installation and a fire results, is the company in any way responsible?

A. An electric light company is not responsible for damages occasioned by fire resulting from a defective installation, unless the company itself furnishes or maintains the installation, or has notice of the defect, or negligently increases the supply of current beyond the capacity of the installation. There must be some negligence on the part of the company in order to make it responsible in damages. Those who wire their own buildings assume all risks resulting from the character of the wires and the method of construction, but an owner is not required to anticipate and prepare in advance for the access of dangerous or deadly current upon the failure of apparatus entirely under the company's control. A verdict against a company for the death of a customer was upheld in this state, where a defec-

tive transformer permitted a deadly voltage to pass from the primary to the secondary wiring, although the latter was maintained by the deceased. A company must exercise a degree of care in transmitting its current commensurate with the danger due to the high potentiality of the current. An interesting case arose in Brooklyn in 1892, in which it was claimed that fire resulted from the negligent installation of interior wires by the Municipal Electric Light Company. The case was tried three times, the last trial resulting in a verdict of $150,000 against the company. The trial judge, however, dismissed the verdict and gave judgment for the company, and on appeal it was held in that case that the company assumed no obligation to furnish the best material or to use the best method in wiring the building, its only obligation being to use the care and skill ordinarily used by those engaged in like undertakings, and it was only for a failure to perform this duty that it could be held liable. The court decided in that case that the evidence was insufficient to warrant a finding by the jury that the company was negligent in using single-cap mouldings instead of double-cap mouldings for affixing wires to the ceiling, the expert testimony being conflicting as to the proper use of the single-cap moulding. The liability of an electric company for damage arising from fire caused by current will invariably depend upon whether the company has been guilty of negligence; it will not be held liable where the damages are caused wholly by the negligence of another.

SECOND. Will the installation of safe but unapproved wiring in a building vitiate any insurance that may be in force or increase the premium?

A. Answer to this question depends upon the form of policy concerning which inquiry is made. In the city of New York, where the privilege to use electricity by the insured is conditioned upon obtaining a certificate from the New York Board of Fire Underwriters, the use of electricity without such approval might be held to avoid the policy, and this especially if a fire resulted from the presence of electric current. The installation of safe but unapproved wiring in a building insured under a policy not containing the condition above mentioned would not, I believe, vitiate the insurance. I cannot answer the latter part of the question as to the increase of the premium under the circumstances mentioned. That would be a matter to be determined by the insurance company.

John W. Searing, of
Parker, Hatch and Sheehan
New York.

At the time of the Iroquois Theatre fire in Chicago, the local company supplying light to that theatre had a scare, as the first report was that the fire had been caused by defective wiring. The company then adopted a clause which reads as follows: "All wiring and other

electrical equipment in the within mentioned premises, except meters, shall be furnished by the consumer and shall be maintained by the consumer at all times in conformity with the requirements of the Department of Electricity of the City of Chicago and with the reasonable rules and regulations of the company's inspection department, in force from time to time. The company shall not be liable for any loss or injury to the consumer resulting from defective electrical equipment in said premises, and the consumer shall reimburse the company for all loss or damage suffered by the company and shall indemnify the company against liability for any injury or damage suffered by third persons resulting from such defective electrical equipment or from any negligence on the part of the consumer," which we still use in all our contracts for light and power and which we think protects us so far as may be possible.

Robert L. Elliott
Chicago, Ill.

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

I call attention to a recent decision in the Appellate Division of the Supreme Court of the State of New York, in the case of Estabrook *vs.* the Newburg Light, Heat & Power Company, in which the question of insulation was considered, and in which Justice Burr uses the following language in his finding:

"There is no proof that in the original construction the defendant failed to exercise reasonable care. The wires were carried on poles at a height of about 30 feet from the ground. They were of a kind known as No. 4, triple braided, weatherproof, copper wire. With regard to this, the electrical expert called for the plaintiff testified: 'I do not think there is anything better known to the art that can be used for overhead transmission commercially than this wire.' In other words, this wire which was being used here on this pole line was as good wire as could be used or was used anywhere."

This line was operated at 13,000 volts and the above information may be of some value to your correspondent.

E. J. Richards, General Superintendent
Connecticut River Transmission Co.
Fitchburg, Mass.

NEW QUESTIONS

0—84. What attempt is being made to standardize the charging plugs for electric vehicles? We have recently had to provide five different plugs.

0—85. The manager of one of our moving-picture shows has conceived the idea of a telephone to reproduce at the entrance the music of his inside orchestra with sufficient volume to attract the attention of the passers-by. We would like to know if member companies have any shows with a similar apparatus in successful operation, or if any have been tried, and have proved unsuccessful.

5—10. What does it cost member companies to clean Babcock and Wilcox Boilers?

10—43. How can the armature of a 110-volt shunt wound ¼-kilowatt D. C. dynamo be changed to give about the same kilowatt output at 8-volts, leaving the fields as they are and exciting from a 110-volt source?

11—20. What is the practise of transmission companies having oil switches on high-voltage circuits (15 and 30 K. V.) in inspecting and changing the oil? Is the sediment which forms in the oil detrimental to their operation?

12—42. We contemplate installing about a 30-mile, 3-phase, 60-cycle, 2000 kilowatt transmission line. We are considering aluminum against copper for conductors. Any information regarding the experience of companies that have used aluminum instead of copper will be appreciated.

15—52. I would like the opinion of power transmission companies who have high-voltage, air-cooled transformers and regulators, as to the best method of removing accumulated dust, and how often it is done?

15—53. What has been the experience of member companies with standard types of current transformers?

If accidents have occurred, what has been the size of the transformer and the potential and amount of energy behind it?

15—54. What kind of primary fuse is best to use on potential transformers? Should the secondary be fused, and, if so, is it necessary to have the fuse at the transformer?

16—37. I would like information regarding all cities where ornamental posts, using other than tungsten lamps, have been installed for ornamental street lighting or for improvement of business streets.

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40- and 80-watt tungsten series lamp.

16—39. We have a very large customer, for whom we have installed eight flaming arc lamps in his factory. A gas arc lamp company has been after him to install gas arcs and he is half-way converted, but wants us to present our side of the case before he decides. What are the best arguments we can use? Can you refer us to bulletins or literature of any kind, likely to prove useful?

16—40. We have during the last two months been trying out the "Pemco" tungsten arc lamp equipped with 250-watt, 6.6 ampere series Mazda lamps and roughed inside globes, in comparison with 6.6 ampere series inclosed arc lamp with opal inner globes, for street lighting in our city. We would like to hear the opinions of other central stations, if there are any that have tried these lamps, as to the comparative efficiency of the two lamps for street lighting service.

19—47. What has been the experience of companies with the use of refrigeration plants in apartment houses? In groceries? In saloons?

19—48. We have in this section and within reach of our lines a great many saw mills, furniture factories and wood manufacturing plants. Considering the average type of engines in these plants, we believe that there is no doubt that the quality and quantity of their output can be improved a large per cent by the application of electric drive with its maintenance of an even speed for all loads; other advantages would be, improved insurance rates, economy in help, minimum repairs and minimum interruptions.

The problem that really confronts us is due to the low cost of fuel where wood refuse is used for fuel purposes.. Most of the factories require steam for dry kiln and gluing purposes and in some cases for heating.

We would say that our power rates are equal to the best water-power rates existing in this section.

Can you give us any information which will assist us in dealing with this situation, as follows:

What and where is there a demand for wood refuse? .How can we create a demand locally and otherwise? What similar conditions prevail in other sections, and if they are met, how?

We would care to have any and all information and data that has any bearing on this situation and which will aid us in getting some of this desirable business.

20—75. When a meter reader or inspector finds a "jumper" around a meter, what is the customary procedure to obtain conviction and punishment of the customer?

20—76. Will some member company give information in regard

to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

20—77. What success have member companies had with the "Routine Test on Premises"? What is the comparative cost between this and the "Routine Change and Test"? Which produces best results?

22—46. What is approximately the average charge per pair of flaming arcs (commercial lighting) in cities which make special rates for this class of lighting? I believe that we have been selling this light at a price lower than we can take care of these lamps, and I would be very glad to know what others are receiving for such service.

22—47. Wanted: Information from member companies, regarding the amount spent by the cities in which they are located per square mile for street lighting service.. In other words, I wish the result obtained by dividing the number of square miles in the city by the yearly appropriation for street lights.

22—48. When signing on a demand basis, do any companies sign up tungsten lamps on a candle-power basis?

22—49. Do any companies furnish free tungsten lamps and transformers on flat rate sign contracts?

22—50. Has any medium or large sized city had any experience with flat rate residence lighting, and is it satisfactory?

What experience have companies had with flat rate residence lighting rates where the maximum demand meter has been installed?

23—25. What is the average revenue obtained by member companies on electric irons, toasters and sewing-machine motors?

23—26. Wanted: Information from member companies as to what use they make of the Hollerith system in addition to recording and analyzing earnings.

23—27. In companies of 10,000 or more customers, how many monthly accounts are assigned to one bookkeeper?

23—28. Do any member companies of 10,000 customers or more assign the billing and bookkeeping in connection with customers' accounts to one employe, or do they have separate bill clerks and bookkeepers?

23—29. Do companies with 5,000 or more customers, in their compilation of connection reports, include as "connections" sales of cooking and heating appliances?

24—46. Since the recent hearing before the Interstate Commerce Commission, the papers and magazines have been full of the doctrine of efficiency or scientific management, implying, in general, that in many cases by scientific planning, employes as individuals and the organization as a whole, can accomplish more work with less expenditure of time and effort, thereby enabling individual wages to be increased, and yet a saving effected to the corporation.

Assuming for the sake of argument that scientific management, so-called, can accomplish a large part of what is claimed for it in industrial establishments, and even in railroads, is there any opportunity to effect a similar saving in electric light and power companies?

24—47. What have member companies found to be the best method of handling free lamp renewals, by periodic renewals or by request renewals?

Do member companies renew the lamps in the socket, or do they deliver them to the door and exchange for the old lamps and let the consumers put them in the sockets, or does the representative of the company go through the house and renew them?

Do member companies consider it a good practise to go through the houses? If so, why? If not so, why?

What is the object of periodic lamp renewals?

24—48.—We are contemplating putting in an ice- and cold-storage plant in connection with our water and light plant. What do you think of the advisability of this addition? .The ice consumption of our town (2,000 inhabitants—location, West Virignia) is now furnished by an old plant that is not going to run any longer on account of much needed repairs.

24—49. Do member companies allow vacations to all employes, and, if so, what length of time is allowed to different grades of employes, i. e., does a long term of service entitle an employe to a greater vacation than a short term?

24—50. Do member companies with 5,000 or more customers, who supply free carbon lamps and renewals, start each new account with a new outfit of lamps, or in case of "succeeding" customers, does the new account simply fall heir to the lamps of the old customer and start that way? In other words, does the company, of its own volition, start every new customer with a new outfit of lamps, or does it simply fill up empty sockets, or does it wait till the new "succeeding" customer demands lamps?

24—51. How do companies who house 100 or more employes under one roof handle the matter of their employes' clothing, especially in the winter season? Are lockers provided, and, if so, how many employes per locker? Does any company maintain a room for checking employes' clothing. Would such an arrangement be feasible?

25—10. What states have statutes giving the right of eminent domain to power generating and transmission companies for pole lines? Is there available a pamphlet or book containing copies of all existing statutes covering this point?

25—11. Would like to have copies of or information concerning laws governing the appointment of and duties of municipal inspectors in cities and towns where it is necessary to have an inspection previous to the installation being connected to central-station service.

Repeated Questions

The following recent questions have received no reply or else it is felt that further replies are called for and would be of value. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

0—33. In the case of companies whose employes have clubs or benefit associations, is it the custom to have associate members who are not employes of the company? What is the usual membership fee for such associate members? Is it considered a successful plan to have such members, or is the disadvantage of wiring contractors and others feeling that they must join more than the advantage from the income they give the club or association?

***3—7.** Given the following conditions: A noncondensing plant consisting of a 4-valve engine belted to a 150-kilowatt generator and a cross compound Corliss engine (ratio of cylinders 3½ to 1) direct connected to a 250-kilowatt generator. Company has surface wells that will furnish three or four times as much water (very hard) as is required for the boilers. The small unit has practically a full load for 24 hours per day and the large unit is loaded for about six hours per day. Would it pay to install a condenser and cooling tower to get good water for the boilers? Would the condenser and tower pay from an ecomony standpoint?

4—3. Will any member having reliable data regarding thermal efficiency of house heating devices, hot air, or steam generators, please send such data to the Question Box?

5—8. Has there ever been a satisfactory solution for scale in boilers in a plant running noncondensing and using very hard water? If so, what is it?

***6—3.** Based on a 100-kilowatt unit, supplying a load varying from 12-kilowatts to 80-kilowatts, with 12-kilowatts for about ten hours out of twenty-four, which unit would give us the best all-day efficiency? —An A. C. condensing steam turbine unit, a direct-connected single-valve high-speed unit noncondensing, or a medium speed four-valve non-condensing unit.

What is the efficiency of each of these units in pounds steam per kilowatt-hour for ¾ load, for ½ load, for ¼ load, for 1/5 load, for 1/10 load?

6—4. We have a 100 and a 50 horse-power Westinghouse compound engine, separately belted to a 75 and a 40-kilowatt Westinghouse 60-cycle alternator respectively. Run dark hours till midnight; morning run 6 months in year. Maximum load—winter, 70-kilowatts; summer, 40-kilowatts; coal best Iowa steam, $2.45 in bin. Two H. T. boilers, but only one outfit used at a time. To save coal, what would be

best change, with least expense? State probable saving. Which engine would be best, and size, Corliss slow speed, Skinner high speed or Corliss 4-valve?

12—28. Will some member company which has used concrete poles tell something as to results and costs?

12—41. What system is found to be the most satisfactory in distributing alternating current at 2,300-volts for single-phase lighting? Kindly submit sketch showing arrangement of feeders, mains, sub-mains, etc.

18—14. With what success has lead-covered, steel-armored cable been used in underground construction for series street lighting systems, especially on alternating current systems?

***20—72. What has been the experience of member companies with polyphase rotating testing standards?**

20—74. On a 3-phase, 60-cycle system it is desired to measure each month the maximum K. V. A. load (not the actual kilowatts) of a customer using induction motors. Whatever instruments are used must have a time lag of perhaps five minutes, as it is not desired to measure either the starting current or any momentary peak.

What is the best means of accomplishing the object in view, and will any circumstances, not ordinarily to be foreseen, give a false reading, either too high or too low?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

21—22. What companies offer special wiring inducements for outline lighting of buildings? Do consumers furnish lamps and renewals? Does company furnish man and ladders for renewing lamps?

21—23. What has been the experience of member companies as regards paying commissions for the sale of appliances to other than duly appointed commercial representatives?

21—24. What effort has been made to stimulate other than regular salesman to promote the sale of various appliances as well as of the company's product?

21—26. We are fighting hard to secure the business of our city to operate their water-works by electric current. Will member companies who supply current to water-works help us with data and information which might aid us in getting this business?

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

22—40. What member companies, if any, give a special rate for primary motors (2200 volts), or in what way do they modify their contract for secondary motors (220 volts) in order to take care of this class of service?

22—43. What plan do member companies follow in charging customers for welding machines, more particularly spot welders, used in place of riveting sheet metal, taking in one instance four-kilowatts for 5 seconds. The meter does not measure the total watts. What fixed charge per month should be on such machines outside of what is charged over the meter?

23—21. Wanted: Information or recent data relative to the cost on which electric companies base their minimum charges; that is, figures giving general information as to the stand-by or investment cost per kilowatt along the lines of, say, one hundred dollars per kilowatt for station equipment, and then certain figures for overhead line construction, and certain other figures for underground construction per kilowatt capacity, etc.

***23—23. A member company is anxious to have statistics showing the percentage of bills uncollectable of the different companies. As this is a matter on which a general symposium would be of value, companies are requested to contribute information on the subject.**

24—43. Where company regularly inspect signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat rate outline and sign work, where competitive electric lighting companies are in the same field?

24—44. What has been the experience of member companies in promoting, in a systematic manner, suggestions from various employes?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

National Electric Light Association

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THIRTY-FOURTH CONVENTION—NEW YORK
May 29–June 2, 1911

NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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March 20, 1911

CONTENTS

THE COMING NEW YORK CONVENTION

Attention may now be directed to the fact that the work for the thirty-fourth convention, to be held in New York city, is already being taken up actively. This is necessary, in view of the provisions that have to be made for a large gathering. The attendance at St. Louis, when the membership was 5,350, reached 2,700. With a membership of about 8,000 next June, and with a present regional membership of over 1,500, it seems quite reasonable to expect an attendance of from 3,500 to 4,000 during convention week.

Certain features stand out in connection with this meeting which will start the Association on its second quarter century. It is evident that the attendance will be record breaking, but it is also desired that, in utility and practical results, the convention shall make a place of its own in history. There will be four days of business meetings, with an average of eight hours' work daily. The fullest day will be Friday, with at least three sections in meeting both morning and afternoon. This is a

serious innovation, tempered by a rally of the Sons of Jove in the evening at Coney Island. There will be no joint manufacturers' exhibition, this being the practically unanimous decision of the Exhibition Committee and the exhibiting members. It will also probably be a novelty that there will be abundant first-class hotel accommodation for everybody, and that every visitor can register with certainty and comfort in advance. It may also appear more or less of a novelty that in the United Engineering Building all the sections can be in session at once with a maximum of quiet and convenience, and with utmost facility in going from one section to another. Elaborate arrangements are being made to keep the meeting rooms in intercommunication all the time as to items upon the programme.

Emphasis this year in the work of the convention will be laid on the Committee reports. There will, however, be some papers of supplemental value and sterling interest. The new National Sections will be in full swing. The effort will be made to develop the great store of debating strength in the Association along informational and statistical lines.

New York, especially in early June, is an unfailing source of amusement and occupation in itself for the visitor, but the Entertainment Committee will have one or two "numbers" of special distinction, fitting appropriately into the general programme of events. The Association will also have a *Daily*, as the particular contribution of the *Electrical World* to the Convention. Five daily issues will be published.

It may be said in advance that enough is known at this moment of some of the reports to be presented at the Convention to justify the assertion that they will mark an epoch in Association development, and will shape the destinies of the industry far into the future. We desire therefore to urge, particularly upon our member companies, to make their plans and arrangements for participation, at as early a date as possible, not only to assist in the successful working out of details, but to insure the enjoyment to the fullest degree of all the benefits that accrue from membership in the organization, alike to the company and to the individual officers and employes.

N. E. L. A. LIGHTING STATISTICS

It is the custom of the Association to collect each year from member companies data as to the rates for public and private lighting and for power. This year a column was added for electric heating rates. Experience has shown that it is better, in results, to send the blanks out a little after the New Year; and as usual, for 1911 they were mailed during February. It is encouraging to note that out of 921 companies in membership at this writing over 520 have sent in their returns. The work is often attended with considerable detail, and many comp

nies have filed not only printed schedules, but typewritten tables and other data in great fullness. There is thus afforded, in one way, an interesting glimpse into the vagaries of rate making, for every possible theory is involved in the practises exhibited. In some instances, where one company happens to supply several towns and villages, a different schedule has been filed for each place. In one case, where an extra blank was needed, an employe of the company has this year copied the blank in most beautiful penmanship in order to fill it in, instead of writing to headquarters for another printed one. We cannot but admire the calligraphy—and then one wonders as to the reason for so much leisure time and for this curious method of its employment.

By filing these returns, member companies do each other a great service. The figures thus furnished are in constant demand all the year around by other companies, both great and small; and requests for the data often come in by telegraph. Companies are under attack, or are executing a new local street lighting contract, or are making up a new commercial schedule, or wish to compare their rates with those in places of corresponding size; and thus for purposes of offence and defence, as a basis for progress or protection, the figures are incessantly needed. At one time, as older members will remember, the rates were issued each year in a pamphlet to all member companies. In several instances this led to abuse by ill-disposed persons, who secured copies indirectly, and hence for some years it has been the custom to give out only specific data, on specific request. This answers the purpose thoroughly.

The above remarks are written chiefly with the object of calling the matter to the attention of member companies that have not yet sent in their returns. It is asked that, for the general welfare, the data be now placed on file, so that the office can supply it in turn, fully and promptly, whenever and wherever needed by the company membership throughout the country.

MARCH MEETING OF THE EXECUTIVE COMMITTEE

A meeting of the Executive Committee was held on March 9 at the Association offices. Present: W. W. Freeman, president; John F. Gilchrist, Herbert A. Wagner, Alex. J. Campbell, Arthur Williams, George H. Harries, Frank W. Frueauff, Frank M. Tait, Albert R. Granger, W. C. L. Eglin, Dudley Farrand, T. C. Martin, secretary.

The secretary read the financial statement as of March 1, 1911, showing balance of $26,459.20, inclusive of amount invested in bonds and on deposit in Boston, as compared with balance of $21,035.03 on March 1, 1910. Receipts since January 1 figured as $28,187.42, of which $6,041.02 was collected from percentage dues. Since March 1 to date $3,309.78 had been deposited.

The membership statement showed a total membership of 6776, divided into classes as follows: Class A 921, B 4879, C 18, D 217 and E 741.

Applications for membership were read and approved, as noted in the February and March BULLETINS.

Permission to form sections was granted to the companies at Scranton, Pa.; Birmingham, Ala.; Joplin, Mo.; Rock Island, Ill., and Hamilton, Can.

The secretary read a letter from the secretary of the Canadian Electrical Association, stating that that association had voted to affiliate. On motion it was voted that the following resolutions be adopted:

Whereas the Canadian Electrical Association at a meeting on January 20, 1911, voted unanimously to affiliate with the National Electric Light Association,

It is hereby resolved that the Executive Committee of the National Electric Light Association directs its officers to take the necessary steps to put this affiliation into effect, and extends to the sister Association in Canada a hearty welcome and the right hand of fellowship, believing that such affiliation will be for the best interests of the industry in both countries; and

Be it resolved that the Constitution of the Canadian Association as changed to accord with ours, be approved.

The request of the Mississippi Electrical Association for affiliation was read and approved.

Mr. Frueauff, as chairman of the Committee on Organization, read proposed amendments to the Constitution submitted by his committee, stating that the views of the committee were in line with existing conditions, but that it was felt that ultimately the constitution might have to be radically altered. The amendments were referred back to the committee.

On motion of Mr. Williams the following resolutions were adopted:

Whereas bills have been introduced in the New York Legislature during the present session, the object of which is the licensing of professional engineers in New York State,

It is resolved that the Executive Committee of the National Electric Light Association express its disapproval of such legislation as contrary to public welfare and as limiting the freedom with which electrical engineers and others engaged in the central-station industry can practice their profession and calling, and,

Resolved that the officers of the Association watch such legislation, and if it appears necessary, appear before the legislature or its committees at any hearing, to oppose such legislation, and also to take joint action with kindred engineering bodies in protesting against the passage of such acts.

The president stated that bills were also pending in New York State which aim to make it unlawful for a company to make a minimum charge for any service.

On motion of Mr. Williams, it was voted that this matter be referred to the president for such action as he felt wise to take in opposition to such bills.

On motion the following resolutions were adopted:

Whereas an invitation has been received to participate in the International Electrical Congress to be held in Turin in 1911,

Resolved that the Association accept the invitation with thanks and participate officially in said Congress, co-operating with sister electrical societies in this country for the presentation of such papers and reports as may be desired by the authorities of said Congress, and authorizing the president to appoint a representative.

The secretary read a letter from the United States National Committee of the International Electrotechnical Commission with regard to

changing "C" to "I" on the Association badge. On motion of Mr. Farrand, it was voted that the matter be laid on the table.

The matter of an appropriation of $10,000 for the Convention entertainment was discussed at length, and it was voted that the matter be referred to the president with power in consultation with Mr. Williams as chairman of the entertainment committee, and Mr. Eglin as a member of the Finance Committee.

On motion, it was voted that the secretary, at his discretion, arrange accommodations in the Engineering Building for the various sections and others that may desire representation at the time of the convention, May 29-June 2.

The distribution of the Revision of the Question Box was discussed, and on motion it was voted that the secretary be authorized to offer, through publication in the BULLETIN for two successive months, one free copy of the Revision to each Class B member of January 1, 1911, in good standing, who applies for same by May 15, and a copy to be sent to each Class A member.

It was voted to approve a further edition of the Solicitors' Handbook of 1000 copies.

The secretary read a letter from the chairman of the Commonwealth Edison Section, accompanied by a suggested form of standard badge for company sections. On motion of Mr. Williams, it was voted that the matter be referred to Mr. Gilchrist.

It was decided to hold the next meeting of the committee on May 11.

Corporation Tax Upheld

In view of the participation of this Association in steps to ascertain and test the validity of the Federal law taxing local corporations, it may be here noted that on March 13 the United States Supreme Court sustained the law against all objections, and upheld the argument of the Government that the tax was an excise law on the doing of business in a corporate capacity with the advantages that inhere in it. It is not a tax upon the franchises of a corporation or upon its property, and Congress is within its powers in selecting some objects of taxation and omitting others. It will be remembered that the law carries with it also certain features of publicity as to the returns that are made under the law.

International Electrical Congress at Turin

An international electrical congress will be held at Turin, Italy, September 9-20, this year; the Association has been invited to participate and the executive committee has voted to do so. The congress is devoted specifically to applications of electricity; the programme includes several important central-station topics, and the Association will have present delegates who will take up one or more of these subjects in papers or reports. The other American national engineering societies are all co-operating in this work and will help see to it that our country is creditably represented at that time in the land of Volta, Pacinotti, Ferraris and Marconi.

For a fee of $2, the congress can be attended by anyone interested, and for the sum of $5 a member can attend all meetings, vote and receive a copy of the printed transactions. All papers will appear in their original language, but those in French, German or English will be accompanied by a French translation or summary.

The Duke of Abruzzi is at the head of the honorary committee. The International Electrotechnical

Commission will participate; the chairman of the organizing committee is Dr. Lombardi, and the organizing secretaries are Guido Semenza and C. A. Curti, at 10 Via San Paolo, Milan. Mr. Semenza is an electrical engineer very well known in the United States. The membership subscription of any of our members can be forwarded directly to him or through the Association secretary.

New York Convention Hotel Committee

As announced in the February BULLETIN, the Hotel Committee are rapidly rounding the system of hotel reservations into shape. Each member will receive in ample time a detail announcement and schedule of rates. With that announcement will be sent a return post card addressed to Mr. Frank W. Smith, 1170 Broadway, New York City, Chairman of the Committee, which the members may use in requesting their reservation. As soon as the required reservation has been secured the member will be notified by a "reservation card," which will give the member's name, address and accommodations held for him. This card, which will be numbered serially, should be retained by the member and presented at the hotel desk when registering.

It is important that these announcements with regard to the hotel arrangements be sent out by the Committee at the psychological moment and they will be mailed probably not much, if any, before the first of April. Assurance is given by the chairman of the Committee that ample hotel accommodations will be available.

The committee are now ready to make reservations, and if any members desire to anticipate the receipt of the formal circular from the Committee they may communicate with the chairman and will receive a formal acknowledgment and very promptly a "reservation card" as above referred to. Some reservations have already been secured by members.

National Electrical Code

The Electrical Committee of the Underwriters' National Electric Association is to hold its 18th meeting at the New York Board of Fire Underwriters in New York, March 22 and 23, and a pamphlet containing all the proposed and suggested changes and amendments in the rules was sent last week to each member company. These changes embody some important propositions. The Association will be represented at this annual conference by Mr. W. H. Blood, Jr., its insurance expert.

Growth in Membership

During the present month of March the membership of the Association has actually gone far beyond the 7000 line, but after cleaning out all resignations, changes, etc., there was left net on March 18 the grand total of 6988, so that by the time this falls under the reader's eye it is more than likely that a firm total in excess of 7000 will have been attained. Herewith is given a list of 296 new members dating up to the meeting of the Executive Committee, March 9, and not including a list of 163 enrolled in Pittsburgh for the new Section of the Allegheny County Light Company, which started off on February 28 with a membership of 186. The list now printed includes: Class A, 11; Class B, 267; Class C, 1; Class D. 1; Class E, 16, a total of 296.

Revision of the Question Box

For some time past an editorial committee has had in hand the preparation in book form of a "revision" of the first four or five years of the *Question Box*, putting the matter in digested form. This work now approaches conclusion, and the matter is being put in the hands of the printer. A copy of the book will be issued to each Class A company in good standing, and it is proposed to furnish one also to each Class B member up to the end of 1910, who may apply for it by May 15; it being necessary to know in advance the size of the edition that will have to be printed.

New Members

Class A: Morrilton Light & Power Company, Morrilton, Ark.; Lamar Light, Heat & Power Company, Lamar, Colo.; Federal Sign System, Chicago, Ill.; Citizens Gas, Electric & Heating Company, Mt. Vernon, Ill.; Hammond Ice, Light & Bottling Co., Ltd., Hammond, La.; Chestertown Electric Light & Power Company, Chestertown, Md.; Tide Water Power Company, Wilmington, N. C.; Paxtang Electric Company, Harrisburg, Penn.; Cuero Light & Power Co., Cuero, Tex.; Union Central Light & Ice Company, Hubbard City, Tex.; Stamford Gas & Electric Company, Stamford, Tex.

Class B: Fort Smith Light and Traction Company, Ft. Smith, Ark.—R. J. Mack.

Pacific Gas and Electric Company, San Francisco, Cal.—R. C. Bragg, S. F. Galbraith, H. S. Lane, F. C. Platt, F. J. Southerland, Joseph Z. Strauch, S. V. Walton, Francis E. Wilkinson.

San Francisco Gas and Electric Company, San Francisco, Cal.—P. E. Chapman, Fred C. Ensinger, C. A. Gaines, Edward R. Mielenz, Spencer Moore, L. H. Patty, Adolph J. Theis.

Denver Gas and Electric Company, Denver, Colo.—F. D. Burr, L. W. Dickson, Melcher Ekstromer, Fred A. Guthmer, R. A. Hammack, C. C. Henderson, J. F. O'Connor, Curt Sandig, S. A. Sewall, R. B. Stitzer, Robert Thompson, Jr., D. G. Waggoner, W. R. Waggoner, L. R. Warren, A. R. Whisler, Arthur V. Wynne.

Commonwealth Edison Company, Chicago, Ill.—E. Allen, Harry Anderson, G. A. Burnside, Frank Coburn Clarke, C. J. Conley, John B. Cusack, J. H. Dallaske, Raymond A. Dull, Emmett E. Fast, A. S. Fletcher, George Fitzsimmons, John Arthur Fitzsimmons, James L. Fyfe, Stewart M. Heberling, C. J. Hejda, Carl A. Hoffman, Hermann V. von Holst, G. H. Hunstock, A. A. Johnson, A. H. Kean, Howel B. Keeler, Walter F. Kleene, Martin Kraus, William Lasway, C. J. Leonard, Joseph P. McNamara, Fred A. Manau, S. E. Moore, William A. Nelles, T. W. North, Michael O'Malley, Thomas Peat, M. S. Pitlock, Adams W. Prusynski, Fred W. Prucker, Peter Reuter, John P. Schumacher, Jr., R. E. Sheppard, F. L. Singer, J. O. Smith, Ferdinand C. Tamagno, Z. Tomaszewski, J. S. Way, Harry E. Wing, E. J. Wolfe.

North Shore Electric Company, Chicago, Ill.—G. S. Chapman, E. G. Gerhart, E. R. Martin, George L. Price, J. H. Riley, E. C. Theis, William B. Wilder.

Frederick Gas and Electric Company, Frederick, Md.—J. D. Enright.

Edison Electric Illuminating Company, Boston, Mass.—H. M. Briggs.

Connecticut River Transmission Company, Boston, Mass.—Peter L. Peterson.

Meridian Light and Railway Company, Meridian, Miss.—O. A. Aueff, W. S. Bedgood, C. G. Murdock, W. E. Pebworth, George P. Trotter.

Grand Island Electric Company, Grand Island, Neb.—Roy Fleebe, Glenwood Mahar.

Public Service Electric Company, Newark, N. J.—Otto C. Benz, Philip H. Chase, Charles S. Dunn, C. C. Hartinson, J. J. Lake, Stephen G. Thompson.

Hudson River Electric Power Company, Albany, N. Y.—L. B. Abeel, Maynard L. Chambers, F. W. Larkum.

Municipal Gas Company, Albany, N. Y.—M. R. Shaw.

Edison Electric Illuminating Company, Brooklyn, N. Y.—R. C. Bach, Henry R. Boden, Kane Brunner, Harry J. Collins, B. S. Davis, H. A. DeVine, Hiram L. Donnelly, John J. Donnelly, Roman von Fabrice, Onofrio J. B. de Gaetano, John F. Gill, Emmet Gordon, Fred Gudat, Charles F. Hutchinson, Frank E. Jockers, Frank J. Kane, Andrew O. Kohlhof, John P.

Lally, John H. McIntyre, John J. McKane, A. T. Murray, Hugh Joseph O'Brien, Lester Paterson, Richard Peaty, Charles Planitz, Edward G. Regan, L. Rohrer, Leonard Rose, Joseph V. Rivers, James A. Ryan, Charles Schadt, Carl Shulman.

Queens Boro Gas and Electric Company, Far Rockaway, N. Y.—Lewis A. De Waters, Adam Geib, Otto Hillmer, William F. Kuhn, George Lotz, Carlton Macy, Henry J. Southard, E. H. Webster.

N. Y. and Queens Electric Light and Power Company, Long Island City, N. Y.—Francis X. Brady, John W. Carroll, James P. Connelly, J. Norman Fenton, Joseph Fritz, Louis A. Greenberg, H. E. Van Winkle.

Westchester Lighting Company, Mt. Vernon, N. Y.—Michael Abraitys, William E. Davidson, J. Grounds, A. R. Haight.

N. Y. Edison Company, N. Y. City, N. Y.—Roswell Arrighi, Herbert F. Avery, Elizabeth P. Benbury, William H. Bossert, Wilfred H. Boult, W. E. Boyd, John L. Bradburn, Warren A. Brown, Alexander Darlington, D. Davies, W. T. Dempsey, B. Dickinson, William H. English, A. T. Estcourt, W. A. Evans, W. J. Fennell, William F. Foley, E. G. B. Fox, Dominick Foy, W. G. Hackett, Jr.; Edward E. Hill, F. Moreton, Leon A. Jenkins, Anthony J. Keller, William J. Kelly, Michael A. Leddy, J. H. Lintner, Frank Martin, Edward J. K. Mason, Arthur H. Miller, James W. Morrow, Barnard J. Mullen, James N. Musso, W. A. Netterwald, J. B. Noe, Mary R. Ormsbee, William Reid, Olga E. Rilke, Albert B. Rypinsk, George R. Smith, Edgar A. Stephens, Edward B. Toole, George Van Alst, N. R. Van Duyne, Benjamin F. Wilkinson, William C. Zeltner.

United Electric Light and Power Company, N. Y. City, N. Y.—Charles H. Bayer, Robert Dallas, Charles E. Everett, William F. Lyden, Frank P. McArdle, Joseph J. McCann, E. C. O'Donnell, R. I. Shannon, George Walters, William I. Wegge, H. G. Wright.

Northern Westchester Lighting Company, Ossining, N. Y.—Percy E. Collins; J. A. Tounsend, Arthur Wilkins.

Peekskill Light and R.R. Company, Peekskill, N. Y.—Clair L. Woods.

Rochester Railway and Power Company, Rochester, N. Y.—F. H. Patterson, D. H. Rodgers.

Hoosac River Electric Light and Power Company, Schaghticoke, N. Y.—Raymond D. Sherman.

Schenectady Illuminating Company, Schenectady, N. Y.—C. T. Alden, Charles C. Braunhardt, Herbert L. Brown, D. D. Day, Raymond G. Winans.

Syracuse Lighting Company, Syracuse, N. Y.—W. Dwight Cooke, Ralph E. Hecker, J. E. King, John P. Lynch, William F. Pethic, Harry A. Snelgrove, John F. Wilson.

Utica Gas and Electric Company, Utica, N. Y.—William J. Reagan.

Philadelphia Electric Company, Philadelphia, Penn.—Willard C. Barrett, John Henry Bricker, Edmund Currie, Carl Garrett, A. M. Getz, G. H. Greul, Roland I. Hart, William E. Hinkson, Richard A. Huebner, D. F. Kelter, William L. Lyons, John McCarron, William S. McElmoyl, Samuel P. Mackenzie, Lindsay Mills, Paul C. Patterson, W. R. Reeser, J. C. Riley, Franklin P. Smith, James J. Spillan, William H. Wachter, Charles William Wagner.

Consolidated Power and Light Company, Deadwood, S. D.—Morgan M. Maghee.

British Columbia Electric Railway Company, Vancouver, B. C.—J. E. Pacey, F. H. Tappan.

Toronto Electric Light Company, Toronto, Ont.—Harry Amos, Frederick William Bates, Norman P. Curzon, Ernest D. Finkle, William Alfred Howard, Harold E. Jarrett, A. McMillan, James Redsell, Emerson Robertson.

Tagona Water and Light Company, Sault Ste. Marie, Ont.—E. R. Smithrim.

Class C: Hudson River Electric Power Company, Albany, N. Y.—J. P. Gebelein.

Class D: Hyatt Roller Bearing Company, Newark, N. J.

Class E: Minerallac Electric Company, Chicago, Ill.—Frank F. Kinney.

Public Service Publishing Company, Chicago, Ill.—H. J. Gonden.

Pettingell-Andrews Company, Boston, Mass.—A. E. Hanlon.

General Electric Company, N. Y. City, N. Y.—J. D. Brooke, W. E. Brown, Frank Cassirer, E. J. Cheney, Chester D. Crowell, M. W. Franklin, S. C. Lovett, P. E. Matteson, K. A. Pauly, Leslie L. Perry, P. B. Reed, Henry Smith, Herbert F. Wallace.

NEWS OF THE SECTIONS

THE COMPANY SECTION MOVEMENT

During the past Association year the Company Section idea has taken a wider development than ever, while almost without exception the older Sections have continued their careers of usefulness and have grown notably. The signs of healthy interest are seen on every hand, and the record made from month to month in these pages of Section work may be taken as a fair indication of the amount of enthusiasm that is being put into the management of the Sections and the corresponding amount of instruction, good-fellowship—and fun—that the members are deriving. It is hard to estimate fully the general stimulus to loyalty, efficiency, self-improvement and camaraderie that has followed on this widespread adoption of the Company Section idea. It promises to become one of the most fruitful and beneficial of the Association agencies.

The present month has seen a strong and vigorous Company Section spring into being in Pittsburgh, and at the present moment other Sections are being formed, or are planned, at Scranton, Pa.; Joplin, Mo.; Birmingham, Ala., and Hamilton, Canada, and are under active discussion in San Francisco and Rock Island, Ill. Even this list does not embrace the names of all the places at which it is likely Company Sections will soon be formed; and meanwhile we would like to suggest the Section idea to other companies in which the spirit has not yet moved. Not far short of one-half the Class B membership is thus enrolled, and this is in itself a significant proof of the extent to which the plan has already found favor and approved itself in practice.

Big March Meeting of Commonwealth Edison Section

The entertainment committee sprang a big sensation at the meeting of this Section, held on March 2, which taxed the capacity of Recital Hall with a record-breaking attendance of 406 members. The sensation was the introduction of the Commonwealth Edison N. E. L. A. orchestra, an organization of about thirty musical members of the Edison Branch, who had been drilled in secret for the last two months in preparation for the occasion. Their opening number was a musical fantasy known to lovers of ragtime as "Winter," and it would be difficult to say whether several large cracks in the ceiling of Recital Hall were caused by the vigorous efforts of the orchestra or by the vehemence of the subsequent applause. At any rate, the orchestra made a tremendous hit.

Two excellent papers, "The Sixty-Cycle Distribution System," by Paul F. Williams, and "The Transmission System and Low-Tension Distribution," by M. R. Rich, illustrated by stereopticon, occupied the fore part of the evening, and both were received with the closest attention.

The chairman announced a total membership to date of 841, this being an increase of 73½ per cent since the

last annual banquet held by the Section four months ago.

Mr. George H. Jones, the first chairman of the branch, responded to a call for some remarks, with a brief review of the success and growth of the Section, emphasizing the importance of its work in acquainting new members with the company's methods, traditions and various branches of work.

After a brief intermission, the entertainment committee took possession of the stage, and started the "Big Noise," which resolved itself into a delightfully funny and enjoyable minstrel entertainment given by the combined forces of the Glee Club and the N. E. L. A. Orchestra.

Mr. C. H. Bucher, of the contract department, to whose efficient training the orchestra owes much for its auspicious première, conducted the first number. The men went through the rest of their work during the minstrel show with great éclat under the baton of Mr. Harold Wright, of the contract department, who is also the director of the Glee Club. Messrs. W. H. Childs, of the Hyde Park substation; T. J. O'Brien, of the second vice-president's office; Harry Smith, of the contract department, and M. F. McGovern, of the "Electric Shop," played the parts of the end men very successfully, and convulsed the large audience with their bright witticisms and clever local gags.

Mr. Herbert A. Seymour, the suave and dignified editor of the *Electric City Magazine,* was excellently cast as the unsuspicious interlocutor. Despite the limitations of a dinky two-by-four stage and the lack of proper stage accessories, the show was given without a hitch, and every member was applauded with much enthusiasm. Mr. H. L. Gannett and his hard-working assistants in the entertainment committee deserve the greatest credit for their success.

Suggestions and Papers in Philadelphia

The regular monthly meeting of the Philadelphia Electric Company Section was held in the Assembly Room, 1000 Chestnut street, on Monday evening, February 20, 1911.

The membership committee reported that the total membership to date is 420, there having been 154 applications favorably acted upon since September 1, 1910.

The Committee on the Awarding of Prizes reported that 19 suggestions were received and three awards made as follows: 1st prize, Mr. E. S. Wilson; 2nd prize, Mr. W. M. Barnes; 3rd prize, Mr. Geo. G. Finley.

The winning suggestion was to the effect that a competent representative visit each new consumer after the first monthly bill had been delivered in order to be assured that the service is satisfactory, and if possible to interest the new consumer in electrical devices, such as electrical irons, chafing dishes, coffee percolators, etc., etc.; also that a central incandescent lamp station be located, at which all renewed lamps should be graded and redistributed.

The suggestion winning the second prize was that in each issue of *Current News* a part should be set aside for the latest electrical developments, attaching thereto a short description which would place before every employe of the Company the most modern electrical devices as developed.

The third suggestion covered data for solicitors, suggesting that a loose leaf book be developed in which could be placed illustrations of modern devices, such as shades, signs, photographs of interior and exterior lighting, etc.

The committee felt very much gratified at the number of suggestions received, and stated in their

report that each suggestion would be forwarded to the proper person for attention.

The Secretary announced that on Wednesday evening, March 1, at the Commercial Department Branch meeting, a lecture by Mr. Nelson B. Hazeltine, of the Holophane Company, would be presented, the subject being "Reflections and Diffusing Mediums for Artificial Illumination in the Home"; and that on Thursday night, March 2, the Accounting Department would have their meeting, at which papers will be presented, and also a short sketch entitled "His Model Wife." All the employes of the Company were invited to attend these meetings. It was also announced that Dr. Spitzka would deliver his lecture on "The Effects of Electricity on the Human Body" on Monday evening, March 20.

The paper of the evening, "The Work Involved in Handling Consumers' Accounts by the Tabulating System," by Mr. H. R. Kern, was ably presented, and covered that branch of Company accounting pertaining to the consumer, in a very thorough manner. Each step, for both the billing of current and the billing of merchandise, was carefully analyzed; many troubles were pointed out, particular emphasis being given to the many delays which are apparently of little importance, but which materially affect the work of the accounting department. The Hollerith tabulating system, as applied to the work of the Philadelphia Electric Company, was described in a most interesting manner.

Mr. Cremer, representing the Hollerith Company, made a brief address, in which he outlined the history of the machine; it being brought out that it was developed in order to properly record and subdivide the U. S. census reports. It was developed after the census of 1880 and was first used in the census of 1890, it being proved that the work can be done ten times faster, and at one-third the cost of a system employing regular clerical methods.

Both Mr. Kern's and Mr. Cremer's talks provoked considerable discussion, and many points were explained.

Wave Distortion

The members of the North Shore Electric Company's branch, Chicago, were addressed on January 24 by Prof. E. H. Freeman, of the Armour Institute, his subject being "Cause and Effect of Wave Distortion." He showed by means of crayon and stereopticon that wave-form enters into efficiencies and results as potently as power-factor. The damping and amplifying effects of reactance coils and condensers, respectively, were given for concrete cases, involving the 3rd and 5th harmonics.

Prof. Freeman's masterly review of such a broad and interesting subject is typical of the Institute with which he is associated, and was highly appreciated.

Transformers and Incandescent Lamps

The New York Company's Section held its third regular monthly meeting on Monday evening, February 20, 1911, at the Edison Auditorium, No. 44 West 27th street, New York City—about 300 members and their friends being present. The meeting was opened by Mr. Arthur Williams, chairman, promptly at 8 o'clock, and after a short business session, Mr. C. E. Allen of the Westinghouse Electric and Manufacturing Company was introduced, and delivered an able address upon distributing transformers, illustrated with a number of good

lantern slides. Mr. Henry Schroeder of the General Electric Company followed with an illustrated lecture on incandescent lamps, giving the history of the art of their manufacture from the beginning up to date. The subjects were presented in a clear and forceful manner by each of the speakers, and the thanks of the Section were extended.

A vaudeville performance was then given, which proved quite a success, and the Entertainment Committee then provided a very nice luncheon, together with cigars. As this was the first social meeting the Section had had, the officers and committees in charge of the meeting are to be congratulated upon the success of the whole evening.

The Section is growing very rapidly in membership and bids fair soon to reach 1,000.

Organization of a Section at Pittsburg, Pa.

A banquet to the employes of the Alleghany County Light Company was given by the officers at the Hotel Duquesne, Pittsburg, at 6.30 P. M., Tuesday, February 28. The total number of employes of this company is 615 and 156 of the employes accepted the invitation.

A section of the National Electric Light Association was formed, to be known as the County Light Section, and approximately 150 of the employes joined the section. Prior to this time, about 35 of the employes were already Class B members and therefore the section starts with 185. Others have since enrolled.

Mr. H. N. Müller, superintendent of distribution of the Alleghany County Light Company, acted as temporary chairman, Mr. W. H. Donkin, general contracting agent of the company, acted as temporary secretary, and Mr. James M. Graves as temporary treasurer.

Mr. H. H. Scott, chairman of the Membership Committee of the N. E. L. A., gave a very interesting history of the organization, and told of its growth and the objects for which it was striving.

Mr. A. R. Granger, of Chester, Pa., President of the Pennsylvania Electrical Association, followed Mr. Scott and told of the work the Company Sections were doing, particularly the Philadelphia Section, and he dwelt also on the excellent work of the Pennsylvania State Association.

Mr. R. S. Orr, general superintendent of the Allegheny County Light Company, Mr. W. A. Donkin and Mr. F. Uhlenhaut also spoke briefly and pledged their best efforts to make the section a success.

The Real Theory of Rate Making

The February meeting of the Eastern New York Section was held at Schenectady on the evening of February 7. Mr. R. S. Hale of the Edison Electric Illuminating Company of Boston presented a paper on "The Real Theory of Real Rate Making." The paper was extremely interesting, and probably represented one of the most complete analyses ever submitted on this important subject. Mr. Hale did not content himself with mere skeletons and outlines, but delved deep into his subject, supplementing his arguments with personal experiences, figures and details from actual practice.

The paper was very interestingly discussed by Mr. C. D. Crowell of the New York State Public Service Commission. Messrs. J. T. Cowling, and W. J. Clark of the Westchester Lighting Co., Mt. Vernon, N. Y.; Messrs. H. M. Buegler, and A. S. Ives, of the Poughkeepsie Light, Heat & Power Co., Poughkeepsie, N. Y.; Mr. N. J.

Neall, Consulting Engineer, of Boston; Mr. T. M. R. Meikleham, of Meikleham & Dinsmore, engineers, New York; Mr. A. T. Throop of the Utica Gas & Electric Co., Utica, N. Y.; Mr. N. Webb Offutt, of the Schenectady Illuminating Company, and Mr. Chas. B. Chapin of the Empire State Gas & Electric Association, New York City, and others. No fewer than 250 were present at the meeting.

Northern Lights

The regular monthly meeting of the North Shore Electric Company Branch was held Tuesday evening, February 28, 1911, in the meeting room of the Commonwealth-Edison Company, Chicago. The entertainment committee took charge and provided the members with an interesting programme, furnished by local talent.

Mr. Cushing provided two guessing contests, which were very interesting, the winners being Messrs. Parshall and Lynch. One contest was as to distances within the Company's territory. Mr. Lukes addressed the members on the advantages to be derived from membership in the branch by bringing the employes together, enabling them in becoming acquainted with each other to become also more familiar with their respective duties.

A buffet lunch was served to the eighty members and guests present and everybody voted the meeting one of the best the branch had held. The meeting adjourned at 10:15 P. M.

Around the Banquet Board

The Utah Light & Railway Company Section, Salt Lake City, gave its second annual banquet on February 21, as its regular monthly meeting. No fewer than 52 sat down, and *the dinner party did not* disperse until after 11 P. M. Messrs. W. M. Scott, O. A. Honnold, L. W. Sowles, G. B. Walker, W. G. Swaner, A. Manghan, L. B. Hedge, L. J. Riter, H. Groesbeck and Will Browne were the speakers. During the dinner, the Stunt Committee "put over a few live ones" by way of keeping everybody in good humor. This included topical songs, initiating new members in a manner not prescribed by the constitution, putting in fake trouble calls from some notorious quarter of the town, and roasting facetiously sundry officials of the Company.

An Inquiring State of Mind

The Toronto Section tried an experiment at its February Meeting, which proved highly satisfactory to all parties. A sub-committee drew up, and submitted for argument, eight leading questions, dealing with the engineering, commercial and accounting departments of central station work.

These questions were given to the members about ten days before the meeting, so that those desiring to discuss the questions could prepare their arguments and data.

Some twenty members took part in the discussion, and it was voted one of the most successful meetings the Section has yet had. President Freeman is to address the Section on March 24, when a rousing welcome awaits him.

By Way of Appreciation

The busy editor of the "Question Box" received a letter recently from the Hutchinson, Minn., Lighting & Manufacturing Company, in regard to some data furnished. One paragraph of the letter says: "Please accept our sincere thanks for the courtesies extended. We find membership in the N. E. L. A. of real and every-day benefit to us."

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

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EDITORIALS

QUESTION BOX CLASSIFICATION

TO GUIDE BY CLASSIFICATION

To facilitate consultation of the Question Box by members seeking information on specific subjects, and in order to add to its general availability and usefulness, a classification and index* has been arranged, and beginning with this issue will be published monthly.

The classification adopted is, with two additions and a trifling rearrangement, the one that has for some time been utilized for sub-dividing Question Box inquiries. It is hoped that by thus indexing the monthly Question Box output, it will assume a less formidable aspect to the busy man who may feel that he cannot afford time to read through from 50 to 100 pages in search of information of value to him, and yet does not want to miss the monthly opportunity afforded by these columns to keep in touch with the knowledge and experience of the live men of the industry, on current subjects of vital interest to him in his special line of work.

Typographical arrangement of "Question Box" material has also been changed in order to economize space. The appearance of the page may not be as attractive as formerly, but a great deal more information can be packed into the same space, which will mean less delay in publishing contributions, prompter service to inquiring members, and a money saving for the Association.

COMPARISON OF STREET-LIGHTING EXPENDITURES

Question 22-47, which asks for information concerning the amount spent by cities per square mile for street-lighting service, has called forth some interesting and significant replies. The figures given vary from $381 to $17,797.61 per square mile.

The symposium is not as valuable as it otherwise might be, because some of the replies furnish information as to expenditure for electric lighting only, while others give total expenditure for electricity and gas.

This is a subject of such far-reaching importance, and upon which reliable statistics covering the field in a thorough manner would possess such great value for so many central stations, that some method of collecting and tabulating this information should be originated and followed by the Association.

We would suggest that this be done at once by some committee having jurisdiction, our feeling being that no information the Association might gather at the present time could be utilized to better advantage or would be likely to prove of more immediate commercial value.

ARE HOUSEHOLD HEATING APPLIANCES "CONNECTED LOAD"?

The practise of various companies as to whether they include as "connections" in their daily reports sales of cooking and heating appliances, is set forth in this issue in replies to question 23-29.

There seems to be no standard practise in this respect. Some companies do and some companies do not include appliances as "connections."

Possibly the most logical method is described by Mr. Israel as the practise of the Philadelphia Company.

Cooking and heating appliances are not included in the connected load record if used in a socket or receptacle from which a lamp has been temporarily removed, but all appliances for which special receptacles are provided are included as additions to the connected load.

The subject may not be of any great practical importance, but if comparison of connected load records is to possess any real value, it would seem as if practise in this respect should be standardized.

OFF-PEAK RATES

One of the most important series of contributions that is being published monthly in the Question Box is in reply to question 22-37, which relates to off-peak rates, the class of service for which such rates are given, and the method of control. This is a subject of great and growing importance about which there is still much to be learned.

A study of the replies so far published, giving the practise of a number of companies, cannot fail to prove of interest, and may suggest ideas or methods suitable for local application.

ALUMINUM AND WOOD-REFUSE

Where all is of such considerable value and every contribution is of interest to some member or members, it is perhaps unnecessary to call attention or to refer with special emphasis to any particular subjects or replies. What may be of interest or value to one class or group of members might not appeal to an equal extent to another class or group, and vice versa.

It seems to your Editor, however, that there are two or three questions which have called forth this month information of rather unusual significance, to which we may therefore be justified in directing special attention.

For instance, there is question 12-42, the replies to which relate the experience of a number of member companies with aluminum conductors. The information conveyed is certainly very interesting. Is not this subject worthy of more consideration than it seems to have received of late? Might not the Power Transmission Section of the Association advantageously give it adequate consideration, in connection with its report to the coming convention?

The replies to question 19-48 also seem to us to possess special value for a great many companies which have hitherto been unable to secure the business of certain large power consumers, because of the low cost of the wood-refuse by-product used for fuel.

The replies to this inquiry describe how refuse wood can be used to such advantage for other purposes, that it will not pay to utilize it for fuel, making it therefore more profitable to the power consumer to use motor drive with energy supplied by a central station, and to dispose of or distill his wood-refuse rather than to burn it.

These are only two of many subjects that are treated in the following pages in an unusually interesting and comprehensive manner.

All members of the Association are invited to avail themselves of the facilities and privileges of the Question Box, thus gaining a maximum of usefulness from this feature of Association membership.

ANSWERS

BOILERS, ENGINES, TURBINES

3—7. Given the following conditions: A noncondensing plant consisting of a 4-valve engine belted to a 150-kilowatt generator and a cross compound Corliss engine (ratio of cylinders 3½ to 1) direct connected to a 250-kilowatt generator. Company has surface wells that will furnish three or four times as much water (very hard) as is required for the boilers. The small unit has practically a full load for 24 hours per day and the large unit is loaded for about six hours per day. Would it pay to install a condenser and cooling tower to get good water for the boilers? Would the condenser and tower pay from an economy standpoint?

(Also answered in February BULLETIN.)

A. E. Walden, The Baltimore County Water and Electric Co., Baltimore, Md. —Yes. But actual results may vary, depending on climate, elevation, and temperature of water in summer-time. A spray cooling device with rifles and storage basin would probably answer.

4—3. Will any member having reliable data regarding thermal efficiency of house heating devices, hot air, or steam generators, please send such data to the Question Box?

Alfred S. Kellogg, Engineer, Boston, Mass.—My experience has been that great variation in results may be expected from such installations. This is due to both the method of operation and to the design of the installation. However, averages obtain here as elsewhere in engineering work.

Factory tests upon boilers and furnaces show an efficiency of apparatus ranging from 60 per cent to 68 per cent, but under actual conditions of use it is probable that the average householder does not receive a return much exceeding 55 per cent of the thermal value of the fuel used, although under the best conditions of installation and operation this may exceed 60 per cent. In the East, where good anthracite coal is available, it is customary to estimate that 8,000 thermal units will be delivered to the apartment to be warmed for each pound of fuel burned. This is a good working average, and is subject to those variations due to the size of the plant, conditions of installation and management. This applies equally well to hot air furnaces, low pressure steam boilers, and hot water heaters, and the efficiencies named cover the entire installation of heaters, radiators, distribution lines, etc.

It will be understood that such apparatus, when used for heating air from out-of-door temperatures to the accepted room temperature of 70 degrees,

requires a great many more thermal units than the reheating of the air in the apartments by direct radiation, but the relative efficiency will remain the same.

5—7. What are the relative advantages and disadvantages of hand firing and automatic stoker firing of boilers?

(Other replies in February BULLETIN.)

Alfred S. Kellogg, Engineer, Boston, Mass.—Upon this subject a great deal of information has been placed before the engineering fraternity from time to time, notably in the proceedings of the A.S.M.E. and in the bulletins of the U. S. Geological Survey.

I believe it has been the experience of a great many engineers and plant operators that an attractive financial return is not to be expected from the installation of stokers in plants of less than 500 to 700 horse-power capacity. The cost of up-keep in many instances more than offsets the labor savings, unless the boiler plant is worked very close to, or in excess of, its rated capacity.

One advantage claimed for stokers is the ability to burn in an economical manner the cheaper grades of fuel. Such fuel may also be burned in hand-fired plants, but more intelligent firing is needed. This assumes that the draft shall be sufficient for finer grades, however it may be burned.

Under proper management of a stoker plant, a greater combustion economy due to uniformity of furnace conditions may be expected, and with this condition will result also a greater boiler life and more nearly smokeless combustion.

In choosing a stoker care must be exercised that the type is suitable for the available fuel. Chain-grate stokers have proven very successful where highly volatile coals are to be burned. With such fuel it is a question, even with the best manipulation, if boilers can be forced much beyond their rated capacity and not smoke badly. This seems to be a limitation imposed by the fuel which so far has not been successfully gotten around.

The inclined grate stoker is suitable for burning either anthracite, bituminous or the volatile coals of the West. Underfeed stokers are better suited to the two kinds of fuel first mentioned.

In considering the economy of any stoker, the steam cost of operating the stoker engine for the steam blast, or for driving fans, must not be lost sight of. It will require approximately 3 per cent to 5 per cent of the steam generated in the boilers to operate the stoker engine and fan. Good engineering will keep this item of cost near the lower-named figure, but it is quite as apt to be exceeded as otherwise in the average installation. A steam blast for assisting the draft will require approximately twice this amount of steam.

The original investment for a stoker installation is a considerable item and varies from $18 to $38 per horse-power and is subject to a high annual cost for repairs, varying from $3 to $5 or more per square foot of grate.

While the number of firemen required in stoker plants is greatly reduced, more intelligent operators are usually employed than will be found in hand-fired plants. If the custom were otherwise, much better average results would be obtained in hand-fired installations.

The size of the plant, the nature of the load, and the quality and cost of the available fuel are the determining factors in the selection of the method to be employed in firing a plant and in the choice of a stoker.

5—8. Has there ever been a satisfactory solution for scale in boilers in a plant running noncondensing and using very hard water? If so, what is it?

R. D. DeWolf, Rochester, N. Y.—See paper presented to the Rochester Engineering Society on "Water Softening and Purification," by Mr. J. C. W. Greth of Pittsburg.

B. E. Buttles, Denver Gas and Electric Co., Denver, Colorado.—Have a chemist analyze the water. He will then be able to tell you what chemicals may be used in treating the water so it will be free from scale-forming properties when fed into the boiler.

5—10. What does it cost member companies to clean Babcock and Wilcox Boilers?

I. E. Powell, Rochester, N. Y.—A typical case of cleaning one of our 650 horse-power Babcock and Wilcox boilers in service one hundred days is as follows:

Boring tubes with Liberty cleaner	$75.00
Boring circulating tubes	7.00
Cleaning steam drums	18.00
Feed water pipes inside drums	1.00
Total	$101.00

Our cost varies from about $75 to $125 per 650 horse-power boiler, depending on the hardness and thickness of the scale, which varies with the quality of the feed water.

J. B. Mahoney, Superintendent, Connecticut River Power Co., Vernon, Vt.—It is a rather difficult matter to give any definite figures on boiler cleaning, as the cost will vary in different localities, depending on the cost of labor, composition of water and amount of work demanded of the boiler. The writer was connected with a plant in central New York in which were installed eight 500 horse-power Franklin and four 500 horse-power Aultman-Taylor water tube boilers, the latter being very similar in design to the Babcock and Wilcox type.

We maintained an organization of five boiler cleaners at rates varying between $45 and $50 per month each. Two of these were kept on nights constantly blowing flues, two washing down boilers and removing scale from tubes, and the fifth cleaning out combustion chambers. Any or all of these men were required to fill in as firemen in case of absence of any of the regular firemen and were promoted to the positions of firemen in case of vacancies. The arrangement worked satisfactorily and gave excellent results economically.

Exclusive of flue blowing and combustion chamber cleaning, the cost of cleaning the A. & T. boilers was approximately $25. This included washing out the drums, boring scale out of tubes, and removing such refuse as was not taken care of in the regular flue blowing.

6—4. We have a 100 and a 50 horse-power Westinghouse compound engine, separately belted to a 75 and a 40-kilowatt Westinghouse 60-cycle alternator respectively. Run dark hours till midnight; morning run 6 months in year. Maximum load—winter, 70-kilowatts; summer, 40-kilowatts; coal: best Iowa steam, $2.45 in bin. Two H. T. boilers but only one outfit used at a time. To save coal, what would be best change, with least expense? State probable saving. Which engine would be best, and size, Corliss slow speed, Skinner high speed or Corliss 4-valve?

(Also answered in February BULLETIN.)

A. Buys, Ovid Electric Co., Trumansburg, N. Y.—For the conditions named, the engines you have (if in good order) will give as good fuel economy as any steam engine on the market.

Arthur H. Ford, Consulting Engineer, Iowa City, Iowa.—The proper engines to install in the rearrangement of this plant would be Skinner, or other high speed automatic engines of 115 horse-power and 60 horse-power capacity. The use of Corliss engines would be inadmissible because of the greater cost, greater room occupied and the light load at which they would run at much of the time. The data given is insufficient for a determination of the saving which would be effected by making the change; a change might be found inadvisable after making a test of the present installation.

8—4. (a) Has any member company had occasion to compete with crude oil engines?

(b) We would like data on the performance of oil engines from 50 horse-power to 150 horse-power.

(c) If possible, we would like information as to the cost of delivering current at switchboard, also whether this type of engine will operate without an attendant.

(d) Also give data as to the performance of this engine under various loads, ¼, ½, ¾ and full load, and as to its reliability.

(For other replies see February BULLETIN.)

A. Buys, Ovid Electric Co., Trumansburg, N. Y.—A 12" x 18" three-cylinder Diesel engine, rated at 120 brake horse-power, direct connected to a 90 kilowatt

alternator, running air compressor, circulating pump, exciter and with the station lights (1 kilowatt) on alternator, uses 2 gallons of fuel oil per hour. With 40 kilowatts on switchboard uses 4 gallons per hour. With 80 kilowatts on switchboard uses 7.5 gallons per hour.

A 16" x 24" three cylinder engine of the same make, rated at 225 brake horse-power, runing station lights (1 kilowatt) and above auxiliaries, uses 3 gallons of oil per hour. With 45 kilowatts on switchboard this engine uses 5.5 gallons per hour. With 80 kilowatts on switchboard uses 7.5 gallons per hour. With 160 kilowatts on switchboard uses 14 gallons per hour.

This fuel oil costs 2¾ cents per gallon in the vicinity of New York city. This engine is not intended to be operated without an attendant, but in the hands of a competent engineer is as reliable as a steam plant.

GENERATORS, CONVERTERS, SWITCHBOARDS, INSTRUMENTS

10—37. A heavy 230-volt short-circuit occurred on the line of a three-wire private plant. One 230-volt generator and a balancing set were in operation. The short-circuit burned out five sections of the balancer set starting box. How could this occur, both generator and balancing set being protected by circuit-breakers?

(Also answered in February BULLETIN.)

A. F. Bronwell, Inspection Department, Commonwealth Edison Company, Chicago, Ill.—The information given is not comprehensive enough to arrive at a correct diagnosis of the case. This is one of the cases that requires a careful inspection of the equipment concerned before a definite conclusion can be reached.

If there were a permanent ground on the neutral we might arrive at the following conclusions: the short-circuit on the 230-volt line weakened the holding magnet, causing it to release. The short-circuit burning itself clear may have grounded the positive side, assuming that the polarity is as shown on sketch. If coils of the starting box were not entirely cut out by lever returning to off position, we would have the example of a 115-volt motor running on a 230-volt line in series with the resistance coils, and operating a highly excited short-circuited generator. The excess flow of current might cause the coils to burn out, especially if it were an old box. The circuit-breakers may have been of poor design, or set for a heavy current.

10—40. Could we expect good results with a two-phase generator supplying two separate single-phase circuits, one circuit No. 8 wire supplying mixed lighting and motors, the other circuit No. 6 wire supplying purely lighting, by using a buck and boost feeder regulator on one circuit only?

(Also answered in February BULLETIN.)

J. R. Werth, Engineer Lighting Department, General Electric Co., Schenectady, N. Y.—Yes. The two phases of the armature winding of the two-phase generator are usually not electrically connected to each other. We may therefore consider the quarter-phase machine as the practical equivalent of two separate duplicate single-phase generators with the same field current held constant on each. However, if on the lighting phase the voltage is held constant by an automatic generator voltage regulator, or by hand, the voltage on the other phase (mixed power and lighting) will be about 12 per cent lower at full load .8 P. F., and about 12 per cent higher at no load. In other words, a value of field current which would give 112 per cent rated generator voltage at full load 1.0 P. F. would give 100 per cent rated voltage at full load .8 P. F. and 122 per cent rated voltage at no load.

A single-phase buck and boost feeder regulator could easily take care of the 22 per cent voltage range in voltage on the mixed power and lighting circuit.

The above values of voltage are approximately correct at the generator.

However, a feeder regulator or generator voltage regulator can also be adjusted to compensate for line drop if desired.

10—42. A central station of 15,000-kilowatt capacity has a ratio of motor load to lighting load of 2:3, and operates at 72-power factor. Is this fair operation, and what equipment is required to raise power-factor to 88?

(For other replies see February BULLETIN.)

B. J. Denman, The Edison Illuminating Company of Detroit, Detroit, Mich. —If the power-factor is 72 at time of lap load with a ratio of motor load to lighting load of 2 to 3, it would be the resultant of a power-factor of 38 for the motor load and unity for the lighting load, and indicates extremely bad conditions; but if the power-factor is 72 during the day load, it is not at all bad and about what is to be expected on the average power line.

It might be improved slightly by requiring motors to be operated at about full load; but the only practicable way to raise it to 88 per cent is by the use of rotary condensers.

With a power-factor of 72, each 1000 kilowatts of load corresponds to an apparent load of 1390 KVA with a wattless component of 961 KVA.

With a power-factor of 88, each 1000 kilowatt load corresponds to an apparent load of 1135 KVA with a wattless component of 537 KVA.

The difference between 961 and 537 or 423 KVA would have to be supplied for each 1000 kilowatt actual load, requiring a rotary condenser of a capacity of 423 KVA.

These should be installed on the customers' premises in order to reduce the transformer and line losses and improve regulation, but if necessary can be installed in sub-stations.

If installed on customers' premises, and of a capacity of 600 KVA for each 1000 kilowatt load, they can carry a mechanical load of 420 kilowatts and furnish 420 KVA for power-factor correction.

D. W. Roper, Assistant to Chief Operating Engineer, Commonwealth Edison Co., Chicago, Ill.—For a central station of 15,000 kilowatt capacity, with mixed lighting and power load, 72 per cent power-factor appears to be fair for the day load period. The Commonwealth Edison Company have a maximum load of about 30,000 kilowatts on their 60-cycle system. The power-factor on this system averages 70 per cent during the day load period, when the load consists principally of under-loaded induction motors and core loss of lighting transformers, 92 per cent during the evening hours when the motor load is small and the lighting load is large, and about 80 per cent during the early morning hours when the load consists principally of transformers with a little lighting load. If the present load is 15,000 kilowatts at a power-factor of 72 per cent, it would require about 6400 KVA, with a leading power-factor of 90 per cent, to raise the power-factor of the entire system to 88. This leading current could be divided among a number of synchronous motors driving machinery or forming parts of motor-generator sets. The installation of special machines to run only as rotary condensers is not in general advisable unless it will save other investment in addition to generating capacity.

E. F. Lawton, Superintendent, Hartford Electric Light Co., Hartford, Conn. —It would appear that a 72 per cent power-factor with a two-thirds motor and one-third lighting load is lower than would naturally be expected in a station of this size. Our company is furnishing a mixed light and induction motor load during the day, of about 7000 kilowatts at an average power-factor of 85 per cent at this time, with expectations of material improvement, as explained later.

The question as stated would imply a 15,000 KVA rated station capacity of 100 per cent power-factor, which, operating at 72 per cent, would represent an actual capacity of 10,800 kilowatts. It would require a leading wattless current of 4585 KVA introduced into this system to raise this number of kilowatts at 72 per cent to 88 per cent power-factor.

The best solution of this problem cannot be determined from the data given, but off-hand it would appear that the best solution would be, in the first place, to endeavor to make some arrangements with motor consumers whereby their apparently underloaded motors could be run at more nearly full load than at present, thus raising the initial power-factor to start with.

The next step, viewed from the experience of this company, would be to install rotary condenser sets, at or near the end of their various feeders on the secondary side of step-down transformers in a few of the large factories, arranging with them to drive an energy load from these condensers of 70 per cent of their rated capacity, and using the balance of the 70 per cent for power-factor correction.

This would at once remove from the system a large induction motor load at, say, 70 per cent power-factor, substituting therefor a load of unity power-factor, hence a correspondingly smaller induction load to be corrected. The total rotary condenser capacity required to accomplish this result would probably be considerably less than the 4585 KVA capacity above mentioned, if applied in this manner.

The efficiency and increased capacity of step-down transformers, transmission lines, underground cables (if any), as well as station-generating equipment, would be increased in the ratio of 88 per cent $\div$ 72 per cent, or 22 per cent increase, and the voltage regulation wondrously improved.

Our company is now operating but two 200 KVA condensers, but expects to extend their use extensively, looking toward a 90 per cent or slightly better power-factor.

H. L. Wallau, Cleveland, Ohio.—Station operates at 72 per cent P. F. For every kilowatt load the KVA load is 1.39, with a wattless component of $1.39 \times .7 = .973$.

For operation at 88 per cent P. F. the KVA load per kilowatt would be 1.135 with a wattless component of $1.135 \times .475 = .54$.

The difference between the two wattless components $(.973 - .54)$ .233 is therefore the wattless condenser component required per kilowatt of load at 72 per cent P. F. to raise this power-factor to 88 per cent.

Since a condenser operates at about 7 per cent P. F., the KVA capacity of the condenser would be practically the same as its wattless component.

Present operating conditions are not very good since a generator carrying its full load in kilowatts would have an overload of 40 per cent.

Besides this, the field excitation has to be increased to counteract the demagnetization due to the wattless component, which is practically equal to the load in kilowatts.

Eighty-eight per cent power-factor is a much more favorable operating condition.

10—43. How can the armature of a 110-volt shunt wound ¼-kilowatt D. C. dynamo be changed to give about the same kilowatt output at 8-volts, leaving the fields as they are and exciting from a 110-volt source?

Cecil P. Poole, Editor of *Power*, New York.—Divide the number of conductors now in each armature slot by 13; this will give approximately the number of conductors per slot for the new winding. If the result is an odd or a fractional number, take the next higher even number if practicable; if not, take the next lower even number and increase the speed.

For the size of wire to be used, take the standard size nine gauge numbers larger than the size now in the winding and use two wires in parallel for each conductor; or use three in parallel, each seven gauge numbers larger than the 110-volt conductor; or four in parallel of wire six gauge numbers larger than the present wire. The correct combination to be used will depend on the size and shape of the slot and the width of the "mouth" or opening at the edge of the disk.

A. H. Ford, Consulting Engineer, Iowa City, Iowa.—A ¼ kilowatt, 110-volt armature can be wound so as to give approximately the same output at 8 volts, by using wire 11 sizes smaller number B & S, 13 times larger cross section, and having 1/12 as many turns per armature coil.

11—20. What is the practise of transmission companies having oil switches on high-voltage circuits (15 and 30 K. V.) in inspecting and changing the oil? Is the sediment which forms in the oil detrimental to their operation?

Lee B. Allen, New Rochelle, N. Y.—Our H. T. system operates on 13,500 volts, and all switches are oil make and break.

When a switch is opened normally, the arc is entirely broken by the oil, which is a good grade of transformer oil.

Usually on a heavy short-circuit the contacts are burned somewhat, although not enough to form sediment; but when the circuit is cut off for any length of time, the tanks are taken off and contacts and oil examined. If there is a discoloration by carbon deposit, it is thrown out and new oil put in.

On one occasion, one leg of a 3-phase switch opened while carrying about 1700 kilowatts, and arced across the terminals. When closed again by means of a lever, it ran that way for several hours, but the tank was heavily charged, due, no doubt, to a large deposit of carbon dust, as no part of the switch was grounded to the tank.

After disconnecting the switch from the H. T. bus by means of knife-blade switches the oil was changed, as it was black and thick. I think if enough sediment gets in the oil to thicken it, there might be trouble. Heavy, thick oil also interferes with the operation of the switch.

J. B. Mahoney, Superintendent, Connecticut River Power Co., Vernon, Vt.—An inspection or test of the oil in all switches broken under load should be made at least twice a year, and if the oil shows any signs of carbonizing, it should be replaced with good oil. The sediment referred to is carbon and rapidly deteriorates the insulating qualities of the oil. If allowed to accumulate, it will ultimately render the oil worthless and grave damage will be done the switch on some occasion when it is being opened.

It is also good practise to inspect the oil on occasions of extraordinary trouble, such as result from a swinging short circuit on a line when the switch is tripped out repeatedly under heavy currents.

OVERHEAD AND UNDERGROUND LINES

12—28. Will some member company which has used concrete poles tell something as to results and costs?

[Mr. R. D. Coombs of New York, a member of the Overhead Line Construction Committee of the Association, sends to the Question Box a copy of the "Concrete Review," Vol. IV, No. 6. There are 58 pages in this publication, all occupied by an article on Reinforced Concrete Poles, by Mr. Coombs in collaboration with C. L. Slocum. This article covers pretty thoroughly the subject of concrete poles for telephone, telegraph, light and power companies, giving the history of the development of the concrete pole, methods of manufacture, costs of different types, comparative statistics as to life, and information as to tests under ice and wind loads, etc. There are many interesting illustrations.

Any company interested in this subject of concrete poles can secure a lot of information by writing for a copy of this publication to the Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, Pa.

In the *Electric Railway Journal* for September 24, 1910, there is an article entitled "Reinforced Concrete Poles at Fort Wayne and Syracuse," which gives some interesting information as to the making and use of concrete poles by the Fort Wayne and Wabash Valley Traction Company, Syracuse Rapid Transit Company and the Utica and Mohawk Valley Railway Company. The first-named company has now about 200 concrete poles in use.—Editor.]

I. Oesterblom, Brooklyn, N. Y.—The question of using reinforced concrete poles is a comparatively new one, and many engineers consider the results of actual trials rather discouraging. This is undoubtedly due to two causes:

1. One expects a concrete pole to do work that a structural steel pole would not do under similar circumstances and with equal limitations.
2. The theory of design is one of the most intricate problems of reinforced concrete engineering; poles have been manufactured as a result of a good, or, more frequently, a bad guess, with consequent discouraging results, high cost and very small strength.

Below is a table to assist in the design of a pole, square in section and with reinforcement near the two opposed faces, perpendicular to the expected stress.

Size of Section Inches	Reinforcement Each Side Sq. Inches	Ditto Per Cent Each Side	Resisting Moment Foot Pounds
8 x 8	.72	1.44	12,400
9 x 9	1.01	1.55	20,200
10 x 10	1.37	1.66	32,000
11 x 11	1.80	1.77	47,000
12 x 12	2.29	1.87	66,000
13 x 13	2.85	1.95	91,000
14 x 14	3.47	2.02	122,000
15 x 15	4.15	2.09	159,000
16 x 16	4.90	2.15	202,000
17 x 17	5.74	2.20	254,000
18 x 18	6.60	2.25	314,000

The table is based on the most economic utilization of the material and leads to a pole with a slightly curved taper. A perfectly straight taper usually leads to a pole that is weak a short distance below the lowest crossarm or excessively strong at the butt.

The stresses assumed are:

For steel in tension, 40,000 pounds per square inch.

For concrete in compression, 2000 pounds per square inch.

Requiring high-carbon steel and a high-grade concrete.

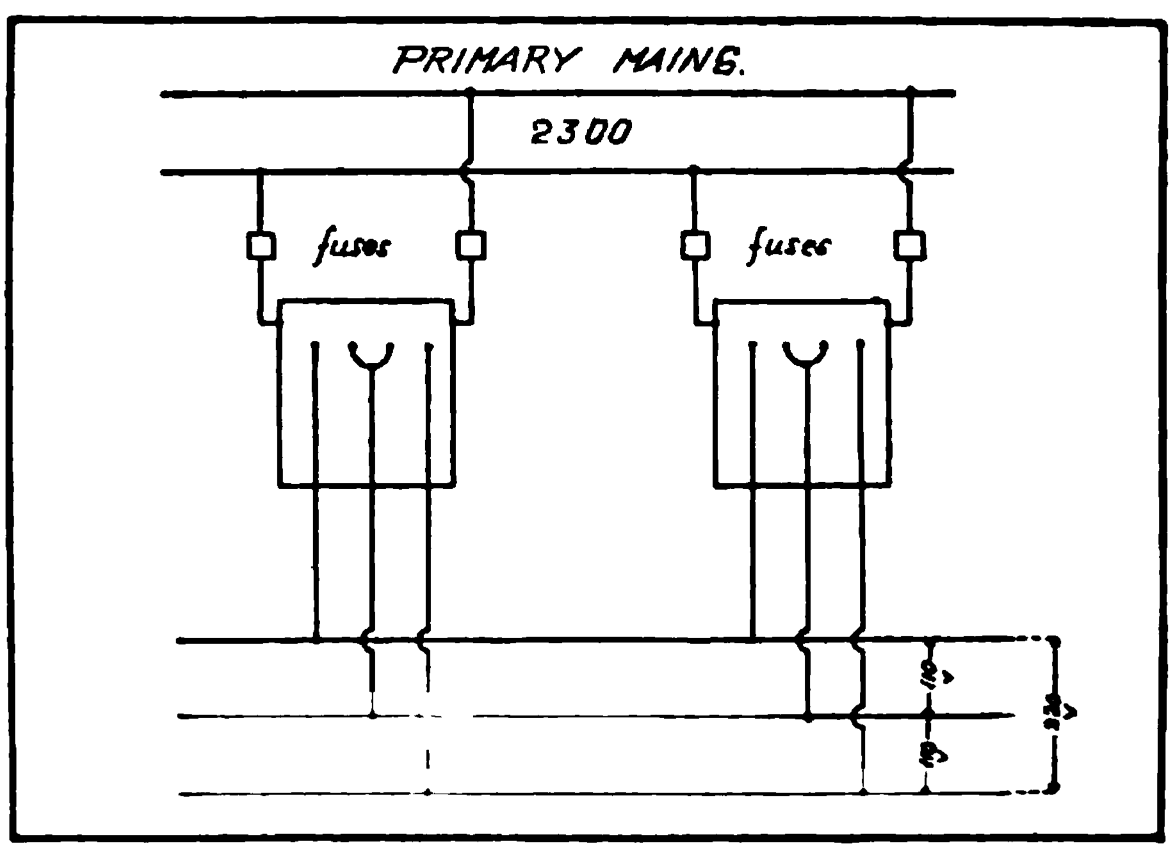
The bars are assumed to be located so that there is a distance of 1 1/3 inches from their centers to the face of the pole.

If proportionately lower material stresses are desired, it gives comparatively fair results to increase actual bending moments in inverse proportion to the reduction in stress and apply this increased moment to the table.

In addition to the longitudinal reinforcement mentioned, which should be placed on two sides only, transverse reinforcement is needed. The hoops should be placed not more than 20 times the side or diameter of the bars and be stout enough to resist the longitudinal shear, which tends to split the poles. There are two points of maximum shear, one at, or immediately below, the lowest crossarm, the other below ground. The one below ground is a function of the depth of sitting, the intensity increasing with a decreasing depth.

Many poles have been made with an excess of reinforcement, and yet failed, whereas a smaller amount, rightly placed, would have made a strong pole.

12—41. What system is found to be the most satisfactory in distributing alternating current at 2300-volts for single-phase lighting? Kindly submit sketch showing arrangement of feeders, mains, sub-mains, etc.



C. W. Chidgey, Westchester Lighting Co., Mt. Vernon, N. Y.—In a business section the Edison three-wire system is found by a great many companies to be the most satisfactory way of distributing alternating current for lighting purposes.

From this system there can be supplied several classes of service, for instance:

110-volt two-wire single-phase
220- " " " "
110/220-volt three-wire single-phase

These services meet the requirements of nearly all consumers for lighting purposes. The system frequently consists of several transformers connected in parallel, as per accompanying sketch. In other cases the transformers are not operated in parallel, but the distributing mains are separated into sections, each supplied by one transformer.

In connecting transformers in parallel, care should be taken that the corresponding primary leads of each transformer must be connected to the same primary main wire, and the secondary leads must be so connected that the secondary voltage of the transformers shall oppose each other.

If this is done, although the secondary coils are connected in series, no current can flow through them until a secondary load is applied.

12—42. We contemplate installing about a 30-mile, 3-phase, 60-cycle, 2000 kilowatt transmission line. We are considering aluminum against copper for conductors. Any information regarding the experience of companies that have used aluminum instead of copper will be appreciated.

In response to this inquiry, Mr. H. W. Buck, of Messrs. Vielé, Blackwell & Buck, New York, forwards a reprint copy of a paper presented by him before the International Electrical Congress of St. Louis, in 1904, and entitled "The Use of Aluminum as an Electrical Conductor." This pamphlet is possibly the most complete publication so far made on this interesting subject. It is too lengthy to reprint in these columns, but a few paragraphs will give some idea of its character. Nothing but a perusal could indicate its comprehensiveness or the large amount of ground covered.

Mr. Buck begins this paper by saying:

About the year 1898, the price of aluminum had been so reduced by the commercial application of the Hall process, that this metal began to come into prominence as a competitor of copper for use as an electrical conductor. In physical charactertistics, aluminum differs materially from copper. Its properties give it some advantages and some disadvantages. Some of its physical constants as it is now manufactured commercially for electrical purposes are as follows: Melting point, 1157 degrees Fahrenheit; elastic limit, 14,000 lbs. per square inch; ultimate strength, 26,000 lbs. per square inch; modulus of elasticity, 9,000,000; electrical conductivity, 62 per cent.; specific gravity, 2.68; coefficient of linear expansion, .000,012,8.

On account of its properties, aluminum is not applicable to all the purposes for which copper is used electrically. At present its electrical utility is confined to (a) bus-bars, (b) high-tension overhead uninsulated conductors, (c) low-voltage feeders, usually insulated with weatherproof braid only.

Aluminum is barred from use in a number of cases on account of the practical impossibility of applying the ordinary methods of soldering. Its surface seems to have a coating of oxide on it at all times, which prevents the adhesion of the soldering metal.

At the present relative cost of the two metals, aluminum is about 10 per cent, or 15 per cent, cheaper than copper of the same resistance. The weight of a unit length of aluminum wire is only 47 per cent of a copper wire of the same length and resistance. Consequently, aluminum can cost $\frac{1.0}{0.47} = 2.13$ times as much as copper per pound and still cost the same as copper per unit length from the standpoint of electrical resistance. As a matter of fact, however, the price of aluminum at present is less than 2.13 times that of copper per pound, so that it is actually cheaper to use aluminum as an electrical conductor than copper, where other considerations do not enter.

BUS-BARS.

Aluminum is particularly well suited for bus-bar constructions. Here no insulation is usually required over the bus-bar metal, while the great saving in weight, and the lower cost, are decided advantages in favor of aluminum.

Care should be taken, however, in using aluminum for such purposes, to provide for expansion and contraction with changes in temperature, which is greater in aluminum than in copper. The increased section of an aluminum bar over a copper bar of the same resistance, affords greater radiating surface and allows a given current to be carried with a lower rise in temperature. Consequently, for a given temperature rise, which is usually the limitation in a bus-bar installation, and not "drop," an aluminum bar will weigh only about 38 per cent of a copper bar for the same heating. This is an obvious advantage for aluminum. Such bars are being used extensively for carrying currents of very large volume, such as are required in low-voltage electrolytic plants.

LOW-VOLTAGE FEEDERS.

A very wide application of aluminum has developed for low-voltage direct-current feeders, especially for railway work. Sizes up to 2,000,000 c.m. are in use for railway feeders, the cables being usually covered with weatherproof braid. Aluminum has many especial advantages for this purpose. The quality of the poles and cross-arms frequently installed for the support of railway feeders is not of the best, and the 53 per cent reduction in weight in the use of aluminum saves in maintenance and in line breakdowns. The cost again enters as a 10 per cent or 15 per cent advantage. Furthermore, the increased radiating surface of the aluminum feeder allows a greater overload to be carried by it than with copper, without melting out the compound of the weatherproof braid, which happens so frequently in copper feeders from overheating, when cars become bunched on the line.

HIGH-VOLTAGE OVERHEAD LINES.

The most prominent use of aluminum, electrically, and the one over which there has been the greatest amount of discussion, is that for over-head high-voltage transmission circuits. When aluminum was first introduced for overhead conductors, it was furnished in the solid form. Considerable trouble was experienced with this kind of wire from breakage resulting from flaws in the metal, and from "crystallizing" of the wire from swaying in the wind. About the year 1900, the stranded form was substituted for even the smallest sizes (No. 4 B. & S.), and the original trouble from breakage has been entirely eliminated.

Julian C. Smith, The Shawinigan Water and Power Cimpany, Montreal, Canada.—We have at the present time about 400 miles of high-tension wire 50,000 volts, using aluminum. The experience we have had is entirely satisfactory, and the cost of maintenance, we believe, is certainly not greater than copper. Should you use aluminum, however, particularly if the climatic conditions are severe, *i. e.*, the range of temperature great, we would earnestly request that you give great attention to the question of sag in your wires, as the most common trouble which inexperienced engineers have in the use of aluminum, is due to the stringing of the wires too tight in the warm weather. In the winter, these lines contract very much more than copper, and as a result stresses are set up which either break the wires or pull the supports out of position.

With proper care in stringing, you will have no trouble whatever with aluminum wire.

Philip P. Barton, Vice-President and General Manager, The Niagara Falls Power Company, Niagara Falls, N. Y.—On page 12 of our pamphlet containing INFORMATION FOR VISITORS, a copy of which is forwarded to you by this mail, you will find a description of our transmission circuits, from which you will gather that our use of aluminum can hardly be regarded as an experiment. Our first aluminum line was built in 1900 and the latest in 1908. Our determination to use aluminum in each case was based mainly upon the question of first cost, due consideration being given to the differences between the physical characteristics of copper and aluminum as affecting the design of the supporting structures.

The description referred to above is as follows:

LONG-DISTANCE DISTRIBUTING PLANTS:

From the step-up transformer plants overhead circuits distribute the electrical power at 22,000 volts to Buffalo, the Tonawandas, Lockport, Olcott and Fort Erie. At various central points, substations are located in which step-

down transformers, converters, etc., are installed, and from which the power is again distributed in convenient form for the local power tenants. From the American step-up transformer station, the long-distance distributing plant to Buffalo comprises two separate and distinct pole lines, 19.5 and 22.5 miles long, carrying four tri-phase transmission circuits. Two circuits consist of copper cable 350,000 circular mils in cross section, approximately 7/10 in. in diameter; the other two circuits are of aluminum cable having a cross section of 500,000 circular mils and a diameter of approximately 8/10 inch. On the Canadian side of the river there are two pole lines carrying three tri-phase 22,000-volt transmission circuits. The poles on this line are steel of special construction designed by the Power Company's engineers. The conductors are aluminum cables, 500,000 circular mils in section and having 37 strands.

Seattle-Tacoma Power Company, Joseph Harisberger, Superintendent, Seattle, Washington.—This company installed in 1898 aluminum transmission lines between Snoqualmie Falls and Tacoma, and Snoqualmie Falls and Seattle, making a total distance of 120 miles of circuit. These circuits first installed were solid aluminum alloyed with a small amount of copper, which was found to be detrimental to the tensile strength of the wire; a great deal of trouble was experienced by the wire breaking.

This wire was replaced in 1903 by seven strand pure aluminum cable and the spacing changed between wires from thirty inches on the old line to seven feet with the aluminum cable. Since the stringing of the cable, we have been entirely free from trouble in the way of the line breaking from causes other than trees reaching the line and blasting of stumps along the line.

Have operated this system at 30,000 volts up to December, 1909, when it was changed over to 60,000 volts. As a whole, the aluminum cable for transmission has been quite satisfactory.

F. B. H. Paine, General Manager, Niagara, Lockport and Ontario Power Company, Buffalo, N. Y.—We have probably 1200 miles of aluminum cable, varying in size from 133,000 c.m. aluminum to 642,000 c.m. aluminum. This cable is used for all voltages from 60,000 down to 2200, and all kinds of spans from 1250 feet down to 100 feet. It has been in use about 5 years. We have had no difficulties with it which would not have been found with any other conductor. In other words, our experience has been entirely satisfactory. The only place that we have used copper was for about 10 miles through a rough country where we had long spans, could not afford to use extremely high towers, and we used copper because of the less sag required. We have also used some copper of small size for little branch line work.

P. M. Downing, Engineer, Pacific Gas and Electric Company, San Francisco, Cal.—The first aluminum lines constructed by this company were of the solid metal, that is, not stranded. It did not prove satisfactory on account of crystallization of the metal near the insulator, due to the vibration in the span. Subsequently other lines were built, using stranded wire in sizes ranging from No. 4 B. and S. to 471,000 c.m. The smaller size has proven unsatisfactory on account of deterioration due to the action of the atmosphere, and we now use nothing smaller than No. 1. Sizes above this have shown little deterioration, notwithstanding the fact that they have been in service for approximately ten years. The greatest disadvantage with the large sizes is on account of not being able to make a satisfactory connection. Copper aluminum joints have been particularly troublesome, owing to electrolytic action. We have endeavored to overcome this by excluding the air from the joint, but with indifferent success. The only means we have of knowing that the joint is not deteriorating is to examine it often.

John C. Parker, Rochester, N. Y.—This company's experience with aluminum is not extensive enough to be conclusive for or against either metal. We believe that there are places where the aluminum is not desirable, owing to the danger of burnoff from tree limbs, etc., occasioned by the lower fusing point of the aluminum. However, the manufacturers of aluminum cable have certain very interesting data which seems to more or less discount this opinion. Aluminum being a softer metal, cannot be handled with carelessness, but this has not been found to be a very decided commercial disadvantage. Tie wires are very easily placed, and joints of high conductivity and good mechanical strength are very readily made. The low specific gravity of aluminum makes it

a very desirable material to use where large sizes would heavily weight cross arms. The aluminum can, in general, be installed to give a slightly higher transmission efficiency at a slightly lower expense than can the copper. It must, however, be strung with a greater sag, which would, in the case of very long spans, entail the use of somewhat higher structures, or else lower clearance at the dip of the sag. In general, it is our belief that the aluminum is a very satisfactory material to use where the right of way is at all clear.

J. B. Mahoney, Superintendent, Connecticut River Power Co., Vernon, Vt.—The writer was formerly connected with a company transmitting at 17,300 volts over a distance of 25 miles with aluminum cable of No. 0 and No. 2 copper equivalent supplying three rotary sub-stations of 600 kilowatts capacity each. These stations operated an interurban road where the service was discontinued between the hours of 2 and 5 A. M.

The line had been built and was in operation some two years before we took hold of it. The construction was let to a well-known concern, who called in the services of an expert in aluminum construction; but it was found necessary shortly after operations were commenced to increase the spacing of the wires, on account of the extra sag required, to keep them from blowing together. This work was done nights after the service was discontinued, at considerable expense.

The first winter we operated the system, a great deal of trouble was experienced in the early hours of cold mornings, due to the wires breaking, and it was found that by leaving the line energized, this trouble was eliminated. The following summer we went over the line carefully and cut slack in such sections as appeared necessary, with somewhat better results the next winter, although some trouble was still experienced, and it was deemed advisable to keep the line energized all the time during the cold months.

The co-efficient of linear expansion of aluminum is very high as compared with copper, which together with its fragility presents the most serious objections to its use for transmission purposes. In climates where a wide variation in temperature occurs and high winds are prevalent, interruptions to service will not be infrequent if it is used. In building the line, it is advisable to call in the services of an expert in this class of work, as the variations in temperature from day to day must be considered, and the ordinary construction lineman is bound to run too little sag. Very close watch must also be kept of all the linemen to prevent their using pliers, as a nick in the wire is almost certain to result disastrously at some future time. A twig or small piece of wire thrown across the line during operation, which would readily be burned off a copper line, or, at most, trip out the switch at the central station, will in all likelihood bring down an aluminum line.

Against these objections there is the difference in first cost in favor of aluminum, but the writer believes this is more than offset by the increased maintenance charges and impairment of service, and particularly so if the service is penalized or is of prime importance.

While the writer was in charge of the properties above referred to, a 60,000-volt line of copper was built from the same central station. Absolutely no trouble was experienced with this line, although subject to the same elements. The copper line, however, was somewhat heavier in construction.

13—14. With what success has lead-covered, steel-armored cable been used in underground construction for series street lighting systems, especially on alternating current systems?

E. W. Stevenson, Hazard Manufacturing Co., Wilkes-Barre, Pa.—There are several references to the retarding effects of iron covers on currents in cables in several of the text-books on the distribution of currents, but unfortunately I do not have any of them by me at present. You should have no difficulty in getting access to them at any good public library.

This I can say, however; it is not good practise to put single cables into an iron conduit, when the cables are carrying an alternating current service, nor is it good practice to carry even two single lead-encased in the same conduit; for although it reduces the retardation somewhat, currents are set up in the outer covers of the lead itself, and it is the sparking across these cables that occasionally causes explosions in gassy manholes. Alternating

current service cables should always be made up duplex, or in case of 3-phase alternating current, 3 conductor, under the same sheath. The self-induction in the case of the single is double that of the duplex.

As far as the steel armored, lead-encased cables are concerned there are not many used in this country, as most all cables are now laid in vitrified, or earthenware conduits. One company, I believe, made some up, in competition with European manufacturers, who heretofore seem to have made up considerable of this style. The cables went to Mexico. There is no doubt but what these steel-armored cables have their uses, especially in small towns where there is not much likelihood of extensions, for all that is necessary is to dig a trench and drop the steel-armored cable into it. The steel cover acts as a permanent conduit, and the cable is not likely to become damaged. But in this country the smaller towns are not troubled with æsthetic tastes, and seem to prefer the rough-and-ready method of sticking up a lot of unsightly poles to hang their distribution lines on.

It is presumed your inquirer is referring to steel-tape armor and not steel wire, for the latter is mostly used for subaqueous purposes, short spans crossing streams and rivers.

Advise your inquirer that if he is contemplating the use of such cables, and if they are to be in the same service with overhead circuits, to be very careful that the underground cable part is carefully protected against lightning, with properly placed arresters, or he will have piles of trouble after each electric storm.

TRANSFORMERS, STORAGE BATTERIES, ETC.

15—46. The secondaries of three current transformers, whose primaries are in the three phases of a balanced three-phase circuit, are connected in series, or closed delta, in such a way that the electromotive force of one of them is in the same direction as that of the resultant of the other two. What current will flow in the secondary circuit, and what will be its phase relation?

(Other replies in January BULLETIN.)

Harold W. Brown, Westinghouse Electric & Manufacturing Co., Pittsburg, Pa.—In the second answer to question 15—46 in the January issue of the BULLETIN, it is assumed that the current transformers are "Z" connected for operating relays. The statements made regarding the advantage of this connection over others might be expressed as follows:

On a three-phase circuit, either two or three current transformers are used with overload relays. If three transformers are used they are ordinarily "Z" connected. The chief advantage in the use of "Z" connected transformers is that in case of a ground, each line is protected against overload, whatever the current is in any other line; whereas, with two transformers it is possible to have an overload on one line due to grounding without affecting either relay. Standard coils can be used with either two or three transformers and the effect of unbalancing is the same in either case, except in case of ground.

The currents in the various circuits are represented in the accompanying diagrams.

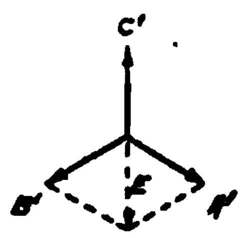


Fig. 3

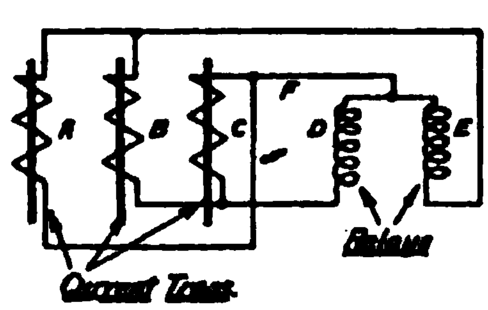


Fig. 1

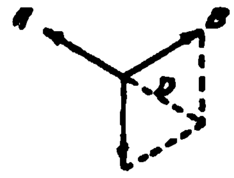


Fig. 2

Fig. 4

Figure No. 1 is a diagram of connections. Figure No. 2 is a vector diagram of the currents from the upper leads of the transformers and figure No. 3 the currents from the lower leads. The three currents flowing from the transformers to the relays are D, E and F. D is the resultant of the currents from the lower leads of transformers B and C. E is the resultant of currents from upper leads of transformers A and B. F is the resultant of currents from the upper lead of C and lower lead of A. If the primary is not grounded, D is the same in phase and amount as in the upper lead of A, and E is the same as the lower lead of C. F is not the same as any other current, but if the load is balanced, F is in quadrature with B and is 1.73 times any one of the other currents.

15—52. I would like the opinion of power transmission companies who have high-voltage, air-cooled transformers and regulators, as to the best method of removing accumulated dust, and how often it is done?

E. W. Babcock, Brooklyn, N. Y.—The best, in fact the only, practical method of cleaning air-cooled transformers, is by blowing out the dust from the coils and air ducts with compressed air. Many of the larger companies have each sub-station equipped with a motor-driven compressor delivering air at from 60 to 80 lbs. pressure to tanks from which it is piped to various convenient points, where a hose with rubber nozzle is attached, for use in blowing out air-blast transformers, rotaries and other machines. The rotaries, dynamos, etc., are usually blown out each time they are shut down. The frequency of cleaning out transformers varies much with local conditions, amount of dust in air, etc. It ranges from once a week with some companies to once a year with others. The cost of such an outfit is in the neighborhood of $400, which includes the piping and labor of installation.

J. B. Mahoney, Superintendent, Connecticut River Power Co., Vernon, Vt.—The company does not use air-cooled transformers or regulators. The writer, however, has had considerable experience with transformers of this type in voltages up to 33,000 and regulators up to 10,000 volts, and found it advisable to blow the apparatus out once each week with compressed air at a pressure of approximately 30 lbs.

15—53. What has been the experience of member companies with standard types of current transformers?

If accidents have occurred, what has been the size of the transformer and the potential and amount of energy behind it?

A. E. Walden, Superintendent, The Baltimore County Water and Electric Company, Baltimore, Md.—"Current transformers" is taken by the writer to refer to current or series transformers used for instrument relays, trip coils, etc. There have been accidents due to the operation of such transformers and the following curves, numbers one and two, taken from tests of two types of these transformers, will give some information as to what will be likely to happen under abnormal conditions or sudden short-circuit calling for an abnormal rise of current in the primary with the resulting increase of voltage and current in the secondary. If used with a wound relay and a short-circuit occurs, then the secondary voltage of the current transformer will rise in proportion to the lines of force, set up by the current in the primary. Likewise the impedance voltage of the relay or trip coil increases with the increased amperes drawn through it and with the position of the core in the relay, with the result that the secondary volts rise to such a point that the transformer breaks down, and this will surely occur if the secondary circuit is open in any manner, or the lead burned off.

Some series transformers with full-rated load for a standard 2000-volt circuit in operation will give an open secondary voltage of about 2000, but may be way in excess of this with transformers designed for higher voltages. The curves shown are similar to the voltage curves of direct-current arc machines, and curve number two shows the effect of more iron and heavier construction and resistance being inserted, reducing the current to 4 amperes. With the full load of 40 amperes in the primary, the voltage increases to 75 volts, which was the limit of the scale on the instrument used for this purpose.

SECONDARY AMPERES

SECONDARY AMPERES

W. H. Lines, Rochester, N. Y.—(1) **Instructions have been given to our operating and meter departments never to open a secondary of a series transformer when potential is on the primary outfit.**

The function of a series transformer is to maintain a constant ratio between the primary and secondary currents. If the secondary circuit is closed there is a constant ratio between the voltages, and also the impedances of primary and secondary coils, according to the fundamental law of induction. Should the secondary be opened, it will have an infinite impedance, and the transformer in endeavoring to discharge its function of maintaining a constant ratio between primary and secondary currents against this infinite impedance will pile up a considerable voltage. Theoretically, an infinite voltage

would be required, but in practise this of course cannot be reached, although a potential dangerous to life would be discharged through any part of the body that might bridge this open circuit at the instant of opening.

(2) The writer knows of one instance when a man was found dead under a testing table, with the leads of an open-circuited series transformer in his hands. The primary voltage in this case was only 220. On a subsequent test of this transformer the voltage across the secondary, when open circuited, reached about 2000.

In some cases it may be absolutely necessary to open the secondary, but no part of the body should ever be allowed to bridge this opening. A similar caution should be observed in opening the shunt field of a direct-current motor, unless a field discharge resistance is provided.

15—54. What kind of primary fuse is best to use on potential transformers? Should the secondary be fused, and, if so, is it necessary to have the fuse at the transformer?

The Johns-Pratt Company, Robert Chas. Cole, Electrical Engineer, Hartford, Conn.—"Noark" enclosed fuses are recommended for the protection of potential transformers. The best practise is not only to protect the primary but also the secondary, unless from an underwriter's standpoint it is not necessary to have the enclosed fuses protecting a secondary at the transformer. The advisability of the double protection afforded by fusing both primary and secondary is at once apparent, for any trouble in the meter will cause the low voltage fuses to open and the renewal expense will be very much less than if the primary fuses were relied upon to open in case of trouble on the secondary side. An entirely new line of 2500, 4400, 6600, 13,200 and 22,000-volt enclosed fuses has recently been developed, which should provide protection for any apparatus now on the market.

L. W. Downes, General Manager, D. and W. Fuse Company, Providence, R. I.—In fusing the primary leads of potential transformers wound for 6600 volts or less, we would suggest the use of special 6600-volt potential transformer fuses. These are made in capacities from 5 amperes down to 0.1 ampere, and are of such dimensions as to fit standard 30 ampere, 600-volt N. E. C. S. cutouts. In mounting these fuses, two single-pole, porcelain-base cutouts, separated by at least four inches, are recommended.

The greatest care should be exercised in order to secure primary fuses of accurate construction and rating, as the ampere input of potential transformers is so small that a slight error in the accuracy of the fuses may permit relatively large overload currents to be admitted.

For potential transformers of voltages higher than 6600, enclosed cartridge fuses of corresponding voltage and proper current rating should be employed.

It affords slight additional protection to fuse the secondary leads of potential transformers, but in common practise this is not done, as the primary fuses will protect the transformer and instruments connected to it, if of reliable construction.

If the secondary circuit is to be fused, it is best done by inserting enclosed cartridge fuses at the transformer leads.

Wherever used, the fuses should be designed to carry about 20 per cent more current than would flow through them if the transformer were loaded to its normal kilovolt-ampere rating.

W. G. Claytor, Electrical Engineer, Roanoke Railway and Electric Company, Roanoke, Va.—You do not state what voltage transformers are used. In our case, we fuse only the primary of potential transformers. For 2300-volt work we use an enclosed cartridge fuse, which is usually furnished by the manufacturer. With transformers for 10,000 volts we use the fuse enclosed in a glass tube.

A. S. MacDowell, Rochester, N. Y.—The voltage of the primary circuit determines the type of fuse. In general, enclosed fuses should always be used, and the bomb type would seem to be preferable on voltages of from 11,000 up. If primaries are fused, it is not strictly necessary to protect secondaries, but the use of secondary fuses is a good precaution, and same should be installed at transformer.

LAMPS AND ILLUMINATING ENGINEERING

16—89. We have a very large customer, for whom we have installed eight flaming arc lamps in his factory. A gas arc lamp company has been after him to install gas arcs and he is half-way converted, but wants us to present our side of the case before he decides. What are the best arguments we can use? Can you refer us to bulletins or literature of any kind, likely to prove useful?

F. W. Le Porin, Manager, Stave Electrical Co., New York.—We take pleasure in handing you herewith the actual cost per candle-power for light produced by our flaming arc lamp:

10 "Stave" Flaming Arc Lamps — 3,000 C.P. each, consuming 550 watts
10 lamps burning 1,000 hours = 30,000,000 C.P. hours
10 lamps @ 550 watts — 1,000 hours = 5,500 K.W.H.

5,500 K.W.H. @ 3 cts.	$165.00
Carbons for 10,000 hours	100.00
	$265.00

or $.0000088 per C.P.

Gas arcs cost more to install and maintain and must either be individually lighted or have an auxiliary sparking device. Gas is liable to freeze, leak, or to cause explosions and is not as favorably looked upon by the fire underwriters.

E. Creed, Sales Manager, The Toronto Electric Light Co., Toronto, Canada. —It has been found that absolutely the best results are produced by electric lighting, especially in the case of work which calls for close confinement. With gas lighting the place is often found to be heavy and flat, and has a distinct stupifying effect, resulting in a languid, heavy-eyed appearance to the workmen, because they are breathing in air, a portion of which is poison, and they breathe it all day; the sudden circulation of the air owing to the combustion in gas lights increases the devitalization of the air, so that the closed shop would, if lighted by gas, be unbearable, owing to the entire exhaustion of oxygen from the air. In large cities it will be found that there are few of the larger institutions operating departments with gas lighting, the reason for this being an economical one, because the men find in gas lighted shops there are always adverse conditions. The only argument in favor of gas is a possible lower cost of operating, and in actual practise the average person is willing to pay twenty to forty per cent advance for electricity. Then, again, with the proper reflectors, full candle-power is delivered on the plane of illumination, whereas with gas, the maximum candle-power is horizontal.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Co., Roanoke, Va.—The conditions mentioned in this question are interesting. We are quite sure that if you will write to the Adams-Bagnall Electric Company, Cleveland, Ohio, and ask for BULLETIN No. 87, under date of March 15, 1910, you will get some valuable data, which can be used in taking care of the conditions you mention. The Gas Company installed outdoor gas arcs of the inverted type for some moving-picture shows at quite an expense. Next door to one of these shows was a five and ten cent store, in front of which store we placed one of the flame arcs mentioned above. The result was that the gas arcs could hardly be found. The gas man lost his temper and insisted that we had failed to give him a square deal. You will note that you can buy these lamps from 5 to 5½, 6, 6½, 7, 7½, amperes each. With the use of these arc lamps, you should experience no trouble in getting rid of the gas installation. If you are in the vicinity of Philadelphia, Mr. R. C. Campbell, representing the Lamp Company, will be glad to call on you and make you a special proposition.

Lloyd Garrison, Ogden, Utah.—A comparison of gas arcs and flame arcs shows approximately the following results:

FLAME ARC.

Mean spherical candle-power per watt	3.6
Lumen-hours per K.W.H.	45,300
Mean L.H.S. candle-power per watt	5.8
Lumen-hours per K.W.H., low hemisphere	36,400

Assuming 100 hours per month burning and the cost of trimming at 20 cents per pair of 17-hour carbons, with an arc wattage of 550, the monthly cost per arc is:

Trimming	$1.40
Energy, 55 K.W.H. @ 10 cents	5.50
Total	$6.90
Total cost per month for 8 arcs	$55.20
Total lumen-hours per month (55 × 45,300)	2,490,000
Same, lower hemisphere (55 × 36,400)	2,000,000
Total lumen-hours per month, 8 arcs	19,900,000
Same, lower hemisphere	16,000,000

OUTSIDE GAS ARC.

Total lumen-hours per cu. ft.	196
Same, lower hemisphere	190
Trimming cost per month, 5 mantle arc	$.50
Gas @ $1 M, 100 hrs., 16.5 cu. ft. hr.	$1.65
Total	$2.15
Total lumen-hours per arc per month	335,000
Same, lower hemisphere	325,000

Therefore the number of gas arcs required to replace the present electric installation and give equivalent light, based on total radiation, is 60, and the cost per month is $129. Based on the radiation in the lower hemisphere the number of lamps required is 49, and the cost per month $106. If the ceiling of the factory is dark the latter figure should be used. Arguments in favor of the electric are the convenience, peculiar penetrating quality of the orange light, more hygienic conditions, initial cost of the gas installation; and for the gas, reliability and absence of flicker.

ELECTRIC POWER—MOTORS

19—44. Will member companies kindly give information relative to aligning shafting for their customers, that is, whether or not they test shafting and report to the customer the condition of the same, or do any other work on shafting?

(Other answers in February BULLETIN.)

Ross B. Mateer, The Denver Gas and Electric Company, Denver, Colo.—The power department tests the load on a motor when requested by the customer or on a sudden jump in current consumption causing a complaint on bill. A careful inspection of the shafting is made at the same time. Such defects as noted are called to the attention of the consumer, who, after rectifying same, frequently requests that another test be made to determine whether the excessive shafting losses have been eliminated.

(Miss) S. M. Sheriden, Sales Manager, Peninsular Electric Light Company, Detroit, Michigan.—Our initial test on power installation always shows the amount of power taken to run the shafting without load. In case of increase in load, we invariably investigate the condition of the shafting, pulleys, etc. We sometimes find that increase in demand is due to the shafting being run at higher speed. We also inspect a customer's shafting and report to him its condition and follow up cases where the installation is not in good shape until the customer has put his shafting in alignment. We also make particular inspection of bearings and frequently recommend installing different type of bearings.

All the information that we have on the power installation is given to the customer.

The New York Edison Company, by K. G. Martin.—While the question involved may be considered as primarily applying to the engineering division of a company in connection with their work for prospective customers, a phase of the question not usually considered is that involved in the handling of complaints from small power users. Throughout the great loft manufacturing

sections of this city there are regular seasons when the work becomes slack and at these times, as the charges for power service in shirtwaist, skirt and similar factories do not decline immediately and in ratio with the actual number of pieces of work turned out, complaints are made that the charges are excessive or inaccurate. In such instances it has been found advisable to add to the general clerical and meter investigation, an installation test, forms being provided upon which are given the current consumption of the motor at various loads, light, normal and full, with voltage readings for each current reading, the total watts and the horse-power, and also a similar set of figures with the motor running alone and with the motor and shafting running alone without load. Such figures generally indicate that the shafting, etc., as is usual in such installations, is not of a high mechanical order and consumes an excessive amount of power, not much variation in current consumption being noticeable between the motor and shafting operating alone and the motor, shafting and light load, and in a great many instances average load, so that we are able to point out to the consumer that a reduction in a number of pieces of work brings about by no means an equivalent reduction in the charges for the service supplied. These tests are made at the discretion of the clerk handling the individual complaint and are carried out without cost to the consumer by special testers operating in conjunction and at the direction of that division of the meter department having to do with complaint tests. No aligning or repairing is undertaken, merely the actual conditions found to exist being reported.

19—45. Will some member kindly advise to what extent alternating motors are used for haulage in mining industry in place of rope or mules?

H. B. Barnes, Engineer, Denver, Colo.—Alternating-current mine locomotives for use on three-phase circuits of either 30 or 60-cycles have been standardized by manufacturers of two of the standard lines of motors. The accepted construction comprises one or more of the standard variable speed-hoist motors of the slip-ring type mounted on a standard locomotive frame. These motors have operating characteristics as to starting and accelerating closely approximating those of direct-current series wound motors. They have, in addition, the extremely valuable characteristic of regenerating power on down grades, permitting the use of the motors for braking, and at the same time permitting an appreciable recovery of energy. An installation in this district of a 4-ton, 220-volt, 60-cycle locomotive, 18-inch gauge, operating on a grade of 3 per cent in favor of the loads, has been in operation nearly a year with absolutely satisfactory results. This locomotive is equipped with two trolleys for collecting current from overhead wires, the rail being used as the third leg of the circuit. A somewhat similar installation in a mine where head-room is limited is using a 440-volt trolley service having the two wires suspended in a vertical plane at one side of the track. The wires are spaced 6 inches apart and a three-wheeled drag trolley is used, connected to the locomotive by means of a drag rope and a flexible duplex cable.

The use of three-phase alternating current locomotives for the higher frequencies (25, 30, and 60-cycles) has been proven to be perfectly feasible, designs having been completed for mine locomotives for 36-inch gauge track, for weights up to and including 8 tons. The ability to use locomotive haulage where only three-phase power is available has attracted the attention of many of the more progressive mine operators. The freedom from first cost, complication and low-operating efficiency characteristic of AC-DC transforming equipment; the constant predetermined speed; the use of the motors in braking on grades; and the possibility of regeneration of power on grades are some of the attractions of this system. The complication of the two trolley wires has in most cases been greatly overestimated, the construction as installed having been satisfactory in every case.

19—46. In the lumbering districts where electric power is used to drive saw mills, are alternating-current motors operated from the line through transformers, or do they install rotary converters and then use direct-current motors?

(Also answered in February BULLETIN.)

J. D. Whittemore, Rochester, N. Y.—In general, there is nothing in saw-mill work that requires a direct-current motor. Therefore, induction motors are

generally used. They have a very distinct advantage over the direct-current motor for two reasons, *i. e.*, freedom from sparking and hence less fire risk, and they require much less care in cleaning and repairing, a very essential characteristic in remote regions where the labor is not familiar with electric motors, and repair parts take a long time to obtain.

Ross B. Mateer, The Denver Gas and Electric Company, Denver, Colo.—Direct-current motors are not satisfactory in lumber mills because of dust and tendency to flash. Polyphase alternating motors arranged for either individual or group drive give perfect satisfaction. Current transmitted to the mill at 2300 volts or higher is reduced to the motor voltage by use of stationary transformers.

19—47. What has been the experience of companies with the use of refrigeration plants in apartment houses? In groceries? In saloons?

R. Louis Lloyd, Philadelphia, Pa.—It is assumed the term "groceries" is used in distinction from straight-out meat shops, but for stores including a meat counter.

We have such a grocery where a 4-ton refrigerating machine is metered together with an elevator, coffee grinder, etc. Case (a)

Another where a 3-ton machine cooling general refrigerator and cheese vault is metered with other motors. Case (b)

A delicatessen store uses a 5-ton machine for cheese rooms, but only five months of the year. Case (c)

A typical saloon installation uses 1½-ton machine cooling beer vault, bar coils, and two boxes, by direct expansion, but in use only since last summer. Case (d)

A brine system, 3-ton machine and brine pump. High-class saloon. Cases carrying bottled goods also cooled. Case (e)

A bar and restaurant, 4-ton machine, with pump, cooling bar and fourteen food boxes, containing about 1,000 feet of 1" piping. Case (f)

No experience with apartment houses.

Case	H. P. Refrig.	H. P. Total	Yearly K. W. Hrs.	High Month	Low Month
(a)	10	14½	6,122	920	68
(b)	7½	18½	15,497	2,161	515
(c)	10	10	4,586	1,280	342
(d)	(5 mos.) 3	3	773	300	88
(e)	7½	8½	12,430	1,383	648
(f)	10	11	25,500	3,700	2,571

[In response to an inquiry concerning this question, the Brunswick Refrigerating Company of New Brunswick, N. J., send a communication, part of which is hereafter quoted, and some of the most attractive and artistic advertising literature we have ever seen. This advertising includes reproductions of letters from various customers who have installed and are using refrigerating and ice-making machinery. These letters are from residences, central stations, grocers, butchers, florists, saloons, etc. They express unanimous and complete satisfaction with the apparatus.

The portion of their letter which may prove of interest we quote as follows:

"The list of users, compressor bulletin No. 101, general refrigeration bulletin No. 103, booklet "Refrigeration in Modern Homes," and list of residence users, which we are sending you under separate cover, will give you some idea of the value to the central station of a small refrigerating plant, which is only a day and summer load.

"Our machines consume, from the smallest residence plant to the largest we build, anywhere from .5 kilowatts to 25 kilowatts per hour. Our residence plants vary from one-quarter ton, consuming .5 kilowatts, to four tons, consuming six to seven kilowatts. These plants are operated in the day time only, and where a number are installed in a locality they help to cut down the rate."
—The Brunswick Refrigerating Co., S. B. Carpinch, Sales Manager.—Editor.]

The Edison Electric Illuminating Co. of Boston, Boston, Mass.—Regarding apartment houses, but very few have taken this up, due in a great measure to the high first cost.

Regarding grocery installations, the greater part of these deal in meat also, and without exception, as far as we know, are perfectly satisfied with their plants in every way.

The duty performed is so variable that it is impossible to give any average cost from size of plant. The majority of our plants are on the Standard "B" or power rate and earn an average of about 3 cents per kilowatt hour, unless consumption is quite small in comparison to maximum use.

Regarding saloons, we have very few at present, although this class is getting more interested. The principal objection, as in apartment houses, is high first cost. One customer who installed plant in January, 1909, has just closed contract for another, to be placed in a new saloon in which he has just become interested.

19—48. We have in this section and within reach of our lines a great many saw mills, furniture factories and wood-manufacturing plants. Considering the average type of engines in these plants, we believe that there is no doubt that the quality and quantity of their output can be improved a large per cent by the application of electric drive with its maintenance of an even speed for all loads; other advantages would be, improved insurance rates, economy in help, minimum repairs and minimum interruptions.

The problem that really confronts us is due to the low cost of fuel where wood refuse is used for fuel purposes. Most of the factories require steam for dry kiln and gluing purposes and in some cases for heating.

We would say that our power rates are equal to the best water-power rates existing in this section.

Can you give us any information which will assist us in dealing with this situation, as follows:

What and where is there a demand for wood refuse? How can we create a demand locally and otherwise? What similar conditions prevail in other sections, and if they are met, how?

We would care to have any and all information and data that has any bearing on this situation and which will aid us in getting some of this desirable business.

The foregoing inquiry was referred by your editor to the United States Department of Agriculture at Washington, with the idea that they might have made some investigations along the line of utilizing wood refuse. This conjecture proved to be correct. The department forwarded a number of publications on the subject, the most interesting and valuable being a pamphlet entitled "Chemical Methods for Utilizing Wood. Including destructive distillation, recovery of turpentine, rosin, and pulp, and the preparation of alcohols and oxalic acid." This was forwarded to the member company making the inquiry. Other companies desiring copies can doubtless secure them from Washington, but for the benefit of all member companies, the introduction and also the final paragraphs of the publication are here quoted.

INTRODUCTION.

"Each year there are millions of cords of wood wasted in the forest and on the farm. This wood, because of its shape, size, or quality, is not suitable for the numerous mechanical uses for which wood is employed, and information regarding other means of disposing of this waste is of general interest. Aside from tanning and paper making, which are chemical industries that have been established for hundreds of years, there are other industrial uses, of more recent origin, which are of agricultural importance because they offer a means of utilizing these wastes of the saw mill and forest. The more important of these are destructive distillation, recovery of turpentine, rosin, and paper pulp, preparation of alcohols, and manufacture of acids. The growth of some of these industries has been rapid in recent years, and is not due alone to the demand for a method of utilizing the waste woods of lumbering operations, such as tops, sawdust, slabs, and timber too small to be profitably handled for lumber, but also to a steadily increasing demand for wood alcohol, acetates, acetone,

turpentine, charcoal, etc., in other industries. In the past, the demand for these products has been sufficient to encourage the steady growth of the industries engaged in their production, and the values of the products have been well maintained, except in so far as the passage of the law permitting the tax-free use of denatured alcohol has affected the price of wood alcohol."

RAW MATERIALS.

"The annual waste (in lumber saw mills), which is now sold for fuel, in the United States, is, according to the Forest Service, equivalent to approximately 4,000,000 cords of wood, or within 800,000 cords of the amount now used in the destructive distillation (1,145,000 cords) and paper-making (3,647,000 cords) industries. If to this be added the waste, such as tops, lap, and dead and down timber left in the woods, this quantity is more than doubled, although no definite figures as to the total quantity can be given. The mill wastes from resinous woods would yield about one-half of the turpentine and a large part of the rosin now produced and several times as much soda pulp as is now made. If the forest waste of resinous woods be added to the mill waste, practically as much turpentine could be produced as is now secured from the living trees. The waste from the hardwood lumber industry would yield more charcoal, wood alcohol and acetate of lime than is now being produced. The sawdust from the Southern pine mills alone will yield more oxalic acid than is now used in this country. The spruce and hemlock waste will yield at least one-half of the sulphite pulp now produced. The question is: Can these industries be most profitably conducted in conjunction with the lumber industry, or independently? While perhaps a categorical answer applicable to all conditions cannot be given at present to this question, the above-mentioned facts strongly indicate that the proper industrial location of the chemical industries using wood as a raw material is in conjunction or close affiliation with the lumber industry. This is particularly true of the wood turpentine industry. Under present conditions as to yield and operating expenses wood turpentine cannot be produced from light wood gathered from the forests at less than approximately 45 cents per gallon. About half of this expense is due to the cost of the wood. If the mill wastes of long-leaved and Norway pine and of Douglas fir are used for recovering turpentine, the cost of production will be reduced approximately half, while the total quantity of turpentine which may be thus recovered will be about 12,000,000 gallons. When the steam process is employed, the distilled wood may be used for fuel or other purposes. Such combination means cheap raw material and fuel for these industries and increased profits for the lumber industry, as well as the removal of waste which otherwise seriously interferes with the use of the land and is a constant menace from fire.

It is seen that the gross values obtained per cord of wood are lowest when the wood is subjected to steam or destructive distillation, and it seems advisable, therefore, that attention be directed more to those methods of utilization which give larger gross values. Thus the recovery of turpentine and rosin by extracting with soda or volatile solvents, and using the residue for paper pulp or for making oxalic acid, are promising methods of utilizing pine wood that are receiving some attention from paper makers and investors, and their industrial value should be carefully determined. The demand for oxalic acid is, however, small as compared with available raw material, and could be readily supplied by a few well-equipped plants. In general, it may be said that all suitable wood should be used in producing the articles of greatest value, such as paper pulp, turpentine, and rosin, leaving oxalic acid to be obtained from part of the sawdust and destructively distilling only that wood which cannot be more profitably utilized.

CONCLUSION.

The production of the articles described in the preceding pages has proved to be reasonably profitable, and will doubtless continue to be. Success, however, can only be expected under proper conditions. The plant must be close to the raw materials, as the latter are too bulky to bear long transportation profitably. There must be an ample water supply, as all chemical processes

require large volumes of water for washing, dissolving and condensing the products, and for making steam for operating the plant. The plant must be well constructed and equipped, that it may be operated with a minimum of power, that losses through incomplete reactions and condensation, imperfect separation, and leakage shall be at a minimum. Operation should be continuous, and, so far as practicable, should be effected with as little hand labor as possible. For each plant certain working conditions will prove the most economic, and these must be discovered and provided. What these conditions are can only be learned through thoroughly competent technical and business control. It is essential that such plants be so managed that the working efficiency of any part can be learned at once and that there be some one who is competent to observe and interpret the results, as it is only in this way that errors are corrected and losses avoided. Those who are unacquainted with the technique of chemical industries are warned in particular against investing in these enterprises without satisfactory evidence as to the efficiency of the particular process and a knowledge that the plant will be under competent business and technical control."

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—We would suggest that the wood-working plant which has an abundance of shavings and sawdust, could get rid of same by either selling this material to livery stables or using it in their own boilers for their dry kilns. To get the greatest efficiency out of this it is necessary that the boilers be located very close to the dry kilns. Some plants of this kind dispose of their end lumber by selling it for fuel.

Ross B. Mateer, Power Expert, Denver Gas and Electric Company, Denver Colorado.—We would suggest that such refuse as can be used for kindling be sorted and sacked and then disposed of to the woodyard; the shavings to be used for livery stable purposes, the sawdust for ice storage, meat markets and powder mills. It will be up to you to create some of these markets, but it is not impossible. Our efforts have been rather successful in Denver, where the conditions are somewhat similar to those you describe.

Wm. Rawson Collier, Atlanta Ga.—Wood blocks can easily be sold as kindling wood or fire-wood to residences. Shavings should find a ready sale as bedding for horses. You should be able to create a demand for the blocks and the shavings by advertising locally.

Investigation will probably show that all of the work in the factory can be done electrically, except the heating of the kiln. If a market is created for the blocks and the shavings, the sale of these by-products will probably furnish more than enough money to pay for coal to be used in firing the boiler used in the dry kiln.

F. T. Williams, Sales and Contract Agent, Roanoke Railway & Electric Company, Roanoke, Va.—We have as a customer the largest building material company in the city. Several years ago, they blew out their boiler head and were unable to operate their plant, having on hand at that time a large number of orders. The manager of this company advised us of his trouble, and as we had a motor the proper size in stock, we promised to have his mill in operation Monday morning. The accident to his boiler happened Friday afternoon. Since that time, they have abolished the use of steam entirely, adding motors as their demand for power increases. At first, of course, the question arose as to the disposition of all refuse. They soon created a market for all sawdust, this being sold to livery stables. The ends, strips and other waste was sold for kindling wood and fuel. I have visited this plant frequently and have never found any accumulation there. The output was materially increased after the installation of motors. Prior to this time, a double surface planer would choke and the operators would have to wait until this machine picked up proper speed. To-day the operation of all machines is constant. Our customer is well pleased and has no desire to go back to the steam engine. The question of disposition of the refuse you speak of would depend to an extent on the location of your various mills. If a dry kiln is used, sawdust and fine refuse could be used for firing boiler and the large refuse could be sold for fuel. This installation which we mentioned has been the means of our securing quite a number of power customers.

METERS

20—72. What has been the experience of member companies with polyphase rotating testing standards?

(Other replies in February BULLETIN.)

Herbert P. Tewksbury, Foreman Electric Meter Department, Denver Gas & Electric Company, Denver, Colo.—We have been using the polyphase rotating standard for two years, testing three-wire, three-phase, and, in some instances, single-phase meters. We also use it in connection with standard current and potential transformers. Our results so far have been very satisfactory. We adjusted this instrument when it was received and it is still running within .2 of one per cent throughout its entire range.

W. G. Claytor, Electrical Engineer, Roanoke Railway & Electric Co., Roanoke, Va.—We have used a polyphase rotating testing standard for about one year, and find it of great convenience in testing polyphase meters under actual working conditions without interefering with customers' service.

C. A. Dean, Cambridge Electric Light Co., Cambridgeport, Mass.—We use a Westinghouse polyphase rotating standard and consider it the best method for testing polyphase meters. We test the greater part of our power meters on the premises, using customers' load, if in the judgment of the test the range of load is broad enough for a satisfactory test.

J. O. McElroy, Supt. Meter. Dept., Great Northern Power Company, Duluth, Minn.—We have used a polyphase rotating standard for the past eighteen months with very good success, and we think that it is the only way to calibrate a polyphase wattmeter on a three-phase load.

20—73. Will member companies please state what they find to be the most satisfactory 3-phase demand meter?

H. W. Peck, Rochester, N. Y.

	Graphic	Printing	Polyphase	Wright
First Cost	High (4)	High (3)	High (2)	Low (1)
Maintenance	High (4)	Low (3)	Low (2)	Low (1)
Reading	Takes time (3)	Takes Time (4)	Easy (1)	Easy (2)
Record	Permanent (1)	Permanent (1)	Lost (3)	Lost (3)
Peak Duration	Exact (1)	Exact (2)	Indefinite (3)	Indefinite (3)
Hour of Peak	Recorded (1)	Recorded (2)	Indefinite (3)	Indefinite (3)
Accuracy	Good (1)	Good (1)	Fair (3)	Fair (4)
Measures	K. W. (1)	K. W. (1)	K. W. (1)	Amperes (2)
Installation	Difficult (4)	Simple (1)	Simple (2)	Fair (3)

Figures indicate my opinion regarding relative desirability of each meter in various respects, (1) being best, (4) least desirable.

20—74. On a 3-phase, 60-cycle system it is desired to measure each month the maximum K. V. A. load (not the actual kilowatts) of a customer using induction motors. Whatever instruments are used must have a time lag of perhaps five minutes, as it is not desired to measure either the starting current or any momentary peak.

What is the best means of accomplishing the object in view, and will any circumstances, not ordinarily to be foreseen, give a false reading, either too high or too low?

(For other replies see February BULLETIN.)

W. F. Howe, Meter Department, General Electric Co., Schenectady, N. Y.—The only instrument which we know of to fulfill customer's requirements would be a Wright demand indicator, which will read the ampere demand and can be multiplied by the normal voltage of the circuit in order to obtain the KVA load

All maximum demand wattmeters measure the demand in kilowatts and not KVA. The Wright demand indicator has the necessary time lag so that momentary peaks or starting currents are not measured. Provided the voltage

can be correctly estimated, there is no reason why the demand indicators should not record the load within commercial limits of accuracy.

Arthur H. Ford, Consulting Engineer, Iowa City, Iowa.—Since the potential at the customer's cutout is probably practically constant, the desired result could be obtained by the installation of a Wright demand meter in each lead. This would require three meters with the appropriate current transformers; but if the cost of the recording device were of sufficient importance to be considered, it would probably be allowable to install a meter in the primary circuit of one of the line transformers, if there were no load on it other than the motor load. The total maximum KVA would then be the indication of the Wright demand meter times the line potential times three for delta-connected transformers.

A. E. Walden, The Baltimore County Water and Electric Co., Baltimore, Md.—Use a graphic ammeter in one phase, with a recording volt-meter.

20—75. When a meter reader or inspector finds a "jumper" around a meter, what is the customary procedure to obtain conviction and punishment of the customer?

The Philadelphia Electric Company, Jos. D. Israel, District Manager, Philadelphia, Pa.—If a meter reader or wiring inspector finds evidence of fraud at a consumer's premises, the matter is immediately reported to the head of the department. Then the meter tester and his assistant are sent to the premises. After this evidence of fraud is verified, the meter tester's assistant phones to the office from a neighboring premises, and then reports to the consumer's premises. We then delegate a man from our commercial force to visit the premises and notify the consumer of our discovery. We insist upon his seeing the conditions in the presence of our three witnesses, and then advise him that we will render bill for undercharge; notifying him that this bill must be paid, together with an item of $15 for boxing the meter, if the current is to be continued. This method secures direct and convincing evidence, and has had such effect upon the consumer that we have not failed to collect our claim in any instance. Thus we receive payment for our account and retain the consumer.

W. G. Claytor, Electrical Engineer, Roanoke Railway & Electric Co., Roanoke, Va.—We have had a number of cases where jumpers have been found around the meter, as well as several other cases where the meter has been tampered with. The meter readers and inspectors have instructions to report any trouble of this kind to the office at once, and experience has taught us that you cannot make your case against these parties unless you can find out the person who has actually done the work. When we have any trouble in getting evidence of this kind we turn the case over to the detective agency, and in practically every case they have been successful in obtaining a conviction, and we always take pains to see that the newspapers publish a complete account of it.

H. B. Preston, Jr., Kansas City, Mo.—When one of our meter readers or inspectors finds a jumper around a meter, he reports same to our office. After looking up the customer's account, we have an inspector watch the place, then at the first opportunity, when customer is using current that is being shunted around the meter, the city electric meter inspector and the city electrician are notified and asked to make inspection. Upon their finding the party using current that is not passing through the meter, our inspector removes the meter, and the city electric meter inspector, in the name of the city, has a warrant issued for the arrest of the customer, who is ordered to appear in the Municipal Court.

This ordinance (making meter frauds a misdemeanor) has been in force since May, 1908, and there have been five court trials under it, conviction having been secured in every case. Ordinarily the defendant does not allow the case to come to trial, preferring to settle the matter, out of court, on the company's terms.

F. J. McCormack, Edison Electric Illuminating Co., Brooklyn, N. Y.—If we suspect that a meter has been tampered with or find a "jumper" around same, it is reported at once by the finder to the general office, who in turn has same

verified by special inspector and if such is the case, meter is disconnected and customer is rendered an estimated bill and meter is left disconnected until bill is paid.

P. W. McCauley, North Shore Electric Co., Chicago, Ill.—When a meter reader discovers a jumper or anything unusual about the wiring around the meter his duty is to take as careful note of it as possible without arousing suspicion, and, if possible, make a sketch of the wiring. Most of all he is cautioned not to say anything of his find to the customer. Acting on his report we then install a check meter on the feeder wires, usually hanging same on a pole in a box. This, when possible, is the same size and type as the customer's house meter. In installing this meter we exercise care not to meter any current but that which passes through the customer's meter. With a few months' reading on the check meter, the amount of current being stolen is ascertained. With this evidence the party is then approached and usually is quite willing to settle the account, in which case nothing is done other than giving a timely warning. If the party refuses to settle the account and sufficient evidence is at hand, he may be prosecuted and made an example of. This can best be judged by local conditions.

20—77. What success have member companies had with the "Routine Test on Premises"? What is the comparative cost between this and the "Routine Change and Test"? Which produces best results?

W. G. Claytor, Electrical Engineer, Roanoke Railway and Electric Company, Roanoke, Va.—We have been testing meters on the customers' premises for about three years, and we believe that it is a great deal cheaper and will give much better results than the "Routine change and test," as under the system we are now using, one meter tester can test an average of fifteen meters per day.

George Ross Green, Philadelphia, Pa.—The replies to questions Nos. 33 and 46, in the Report of the Meter Committee of 1909, give some information on the above subject. Meters should, preferably, always be tested on the consumer's premises. The 1909 Meter Committee discussed this subject at some length in its report.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—In testing meters, we use the "Routine Test on Premises" method and believe it has many advantages over the "Routine Change and Test Method." Following are some of the principal reasons for our favoring the first named method:

Portable instruments and loads of rugged construction and simple operation can be obtained, so accurate tests are possible on the premises.

Changing meters requires a subsequent inspection to be sure of correct connections, etc., and therefore, additional expense and bother to the customer.

There is a large saving of labor by use of the first method, as meter and accounting department records must be altered for each "change order" and it would be necessary to use a man and team in addition to shop tester, which, of course, would more than offset the saving in time between shop testing and "On the Premises" testing. Furthermore, meters tested on the premises are not subjected to the rough treatment that occurs in transportation.

We believe "Routine Testing on Premises" is much cheaper and produces better results.

P. W. McCauley, North Shore Electric Co., Chicago, Ill.—The best results can, without doubt, be obtained by test on the premises, as it affords an opportunity to test the meter in its actual working condition and also eliminates possible error in transporting the meter to service after the shop test, and does away with any chance for the customer to economize on current consumption the month immediately following the test and then demand a rebate for a period back, on the assumption that the old meter was fast, for in emergency we can always give the customer an option of calling in a disinterested party to test the meter at his expense if found correct and at our expense if otherwise, provided the meter has not been removed from the premises. Personally, I believe that once a meter is installed it should not be exchanged unless it is absolutely necessary, even going so far as to make minor repairs on the meter while making the routine test.

COMMERCIAL

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

A St. Louis advertisement:

SNOW

Will Not Keep at Home

THE OWNER OF A

Rauch & Lang Electric

SEE COUPE IN SHOWROOM, TWELFTH AND LOCUST STS., OR PUBLIC ELECTRIC GARAGE, 3920 MORGAN ST.

GUARANTEED BY UNION ELECTRIC
DEMONSTRATION BY APPOINTMENT

21—16. Will member companies give information as to window displays or demonstrations which have proven most effective in attracting attention and making sales?

(Other replies in November, December and February BULLETINS.)

T. F. Kennedy, Denver, Colorado.—For over two years we have had daily demonstrations of every domestic electrical appliance catalogued.

We use a 16-foot mahogany table wired for 110 alternating current. We have a young lady to demonstrate, who works the usual hours of 8.30 to 5.30. This counter is located near our main entrance, compelling the attention of passers-by.

Appliances, such as toasters, water-heaters, percolators, etc., are kept in constant use. This department has paid for itself in the coin of the realm.

Our windows are changed every week. New appliances are installed and kept in motion, on the theory that animation attracts the eye. Placards are placed, reading that the appliances are for free trial.

Our electrical appliance business more than doubled last year over the year 1909.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Company, Roanoke, Va.—About the 15th of last November, we installed in our show room a miniature train. We advertised in the daily papers that this train would operate daily on scheduled time, and also that passes would be given to all children for a free ride. We got in touch with the local newspaper reporter and had him look over this installation. In the next morning's paper, there appeared about a column describing this train in a vivid fashion, telling the children about the tunnels, curves, high speed of the engine, passengers, etc., and advising everybody to see this train. We might say that this display brought people to our salesroom who had never visited this part of the city before. While the train was in operation, there was always a crowd at each window as well as in the salesroom. We were very much pleased with the result of this display and its effect.

21—19. What companies send out circular letters to prospective customers? Are these letters prepared by the local advertising manager, or are special advertising agencies employed?

(See February BULLETIN for other replies.)

G. T. Coggswell, Montgomery Light & Water Power Co., Montgomery, Ala.—The commercial department sends out circular letters. Postage charged to that department. Commercial manager writes all copy for these letters.

Thos. W. Peters, Commercial Agent, Columbus Railroad Co., Columbus, Ga.—This company has adopted the plan of sending out circular letters to "prospects" during the coming year. These letters have been prepared by the local advertising manager.

A. G. Rakestraw, Harrisburg, Pa.—We are sending out circular letters to all prospective customers as reported by our solicitors. These are prepared in our contract department.

21—22. What companies offer special wiring inducements for outline lighting of buildings? Do consumers furnish lamps and renewals? Does company furnish man and ladders for renewing lamps?

Ross B. Mateer, The Denver Gas & Electric Co., Denver, Colo.—A consumer pays for the cost of wiring where buildings are outlined. In case of a large contract the company will furnish the first installation of lamps, provided same are of the carbon type, free of charge, likewise renews all burned out lamps, but the consumer must provide the men and ladders necessary to place the lamps in sockets.

21—23. What has been the experience of member companies as regards paying commissions for the sale of appliances to other than duly appointed commercial representatives?

J. P. Mac Sweeney, Rochester, N. Y.—Our experience has been very satisfactory. This we feel due to the fact that such a plan tends to make a solicitor of every employe, and not the least desirable result of the plan has been the increased activity of the regular force of solicitors made necessary by the operations of other employes.

Thos. W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—We have tried a number of times to interest various church organizations in the sale of electric consuming appliances by offering to pay them commissions on sales, but have not found this plan very lucrative.

A. G. Rakestraw, Harrisburg, Pa.—I do not consider it advisable to employ transient solicitors for this work on a commission basis. Unless the men are carefully selected and closely supervised, they are apt, either intentionally or ignorantly, to make misrepresentations regarding the appliances, which tends to increase the sales but produces future trouble. I think the best plan is to employ permanent solicitors, paying them on a combination salary and commission basis.

Eugene Creed, Sales Manager, The Toronto Electric Light Company, Toronto, Canada.—It will be found in the end that it will be more satisfactory to employ commercial representatives to handle the sale of electric appliances, rather than pay commissions to outsiders. An employe will give far more care and attention to the statements he will make regarding the consumption of current; he will be more familiar with the life of the elements and will aim to give satisfaction for the future.

We have found that well-dressed, attractive, and clever women are most successful.

21—24. What effort has been made to stimulate other than regular salesmen to promote the sale of various appliances as well as of the company's product?

(Also answered in February BULLETIN.)

Arthur E. Main, Electrical Superintendent, Hot Springs Water Co., Hot Springs, Ark.—For the past two years this company has been promoting the sale of electric irons in the following manner:

No. ....

Date .... *190*..

Name ....

Address ....

Issued for ....

By ....

This Coupon Will be.... **No.**

Good for Fifty Cents

At any time within Six Months from date, on presentation at the office of the Hot Springs Water Company, Electric Department, in payment on any part of any bills, in excess of the regular minimum monthly rate, for electric current supplied for lighting purposes to ______________________

at ______________________, in the City of Hot Springs, Arkansas.

Issued ______________ 190 __ By ______________

Books of consecutively numbered coupons are issued to all the dealers selling irons, and when they sell an iron to one of our consumers they fill in the date, name and address in two coupons and in the stubs. This gives the customer one dollar's worth of current with his iron. At 12 cents per kilowatt hour this is only 8 kilowatt hours and we feel that this small amount of "day load current" is well spent in inducing the sale of the iron.

In two years, over 260 irons have been sold in this manner.

21—25. We would be pleased to know what success some of the member companies are having with the use of the Excess Indicator, recently placed on the market; as to its practical operation, commercial features, its ability to draw new business, and its effect on old customers. We operate in a town of about six thousand, where natural gas is very cheap and it may be possible to obtain some new business with this device, but before taking action we would like to know some experience of others with it, especially in towns of our size.

(Other replies in February BULLETIN.)

John G. Learned, Chicago, Ill.—We are experimenting with the excess indicator proposition in a town of about 12,000. We have solicited a list of 300 unwired houses adjacent to our lines, the rate being 1¼ cent per watt per month, with a discount of 20 per cent for cash, the customer to pay for the original installation of lamps and renewals thereof. During a period of two months we have secured twenty-two new customers with a guaranteed income of $1.00 per month each.

We do not put an excess indicator in premises of old customers, the proposition being a special offer to owners or tenants of unwired houses.

A. G. Rakestraw, Harrisburg, Pa.—We are beginning a new business campaign with the aid of the excess indicator, and even at this time we are impressed with the value of this device in meeting the needs of the residence consumer. Reports from other nearby localities where such campaigns have been recently conducted show a very gratifying increase in business due to its use.

E. C. Newman, Concord Electric Company, Concord, N. H.—The system of flat-rate lighting was introduced by us here in Concord about one year ago and has proven very efficient in securing new contracts, the majority of which were in places where we could not have induced the use of electricity through a meter. We have used the excess indicator exclusively, with no trouble whatever arising from defective instruments. We consider this our best grade of business in that the cost of maintenance is practically nil. The original cost of installing an indicator is less than that of a meter and the cost of billing is reduced to a minimum.

Our customers on this system are considered to be the best business getters we have in that they are so well pleased with the service that they are continually bringing us in prospects. A number of our meter customers are changing over to this rate.

21—26. We are fighting hard to secure the business of our city to operate their water-works by electric current. Will member companies who supply current to water-works help us with data and information which might aid us in getting this business?

(Also answered in February BULLETIN.)

B. J. Denman, The Edison Illuminating Company of Detroit, Detroit, Mich.—In three villages where the pumping is done with 2-stage centrifugal pumps of

a capacity of 400 gallons per minute each, direct connected to induction motors, pumping against head of 110 feet, the average for 1910 was 1275 gallons per kilowatt hour.

E. A. Aspnes, Manager, The Montevideo Electric Light and Power Company, Montevideo, Minn.—We have furnished our city current for a 30 horse-power, 3-phase, 220-volt motor for pumping city water. We agreed to sell to the city "surplus power" for 3 cents, to induce the city council to adopt electric power, as a gasoline engine had been depended on for motive power. During a recent burnout of the motor we found that it cost the city about twice as much for gasoline and about three times as much, including one extra man, to run the engine. We therefore feel that 5 or 6 cents per kilowatt hour would hold the business in our case.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Company, Roanoke, Va.—We are supplying power to a municipal plant about eight miles from Roanoke. This station is equipped with two 75 horse-power, 2300-volt, 60-cycle, 3-phase alternating-current motors. The pumps are of the centrifugal three-stage type. We also have before us a report on a municipal pump plant with a capacity of 14,400 gallons per minute against a head of 210 feet operated by two 300 horse-power motors. Such information as we have on these two installations will be forwarded to parties interested on application to this department.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

(Other replies in December, January and February BULLETINS.)

Ross B. Mateer, The Denver Gas and Electric Co., Denver, Colo.—All single-phase power operates on the "Off Peak" schedule. A minimum of $5 net instead of $6.75 net, is given to such rectifiers as adhere strictly to the "Off Peak" schedule. Frequent inspection determines whether the schedule is adhered to. Electric cooking, where desired, is metered on separate meter and the Dougherty rate of charge used.

L. H. Davis, General Manager, Tagona Water and Light Company, Sault Ste. Marie, Ont.—This company makes special off-peak rates, both for power and for heating and cooking, details of which are given under the heading of "Power Rates" and "Heating and Cooking Rates" on our form of Application for Electric Power Service.

Rates 2, 3 and 4 cover off-daily-peak service, and rate 5 covers what may be termed off-yearly peak, and is designed especially to meet motors for refrigeration service.

The above information also is in part an answer to question 22—41.

The paragraphs of Application referred to in the foregoing are as follows:

POWER RATES.

1. For all alternating-current motors rated at less than one horse-power, and for all other alternating-current motors not subject to minimum monthly rates, the commercial lighting meter rate as given below. Whenever a separate meter is required for the motor, the meter rental per month will be 25 cents for single-phase motors and 50 cents for three-phase motors.

2. For all alternating-current motors of one horse-power or over, whose use is limited automatically by the operation of a time switch to the period each day between one-half hour after sunrise and one-half hour before sunset, 2 cents per kilowatt hour for all power used within such period, subject, however, to a minimum charge of $1.25 per month per horse-power of maximum demand and subject to a meter rental of 50 cents per month. Minimum term of contract, one year.

3. For alternating-current motors of one horse-power or over, 2 cents per kilowatt hour for all power used from one-half hour after sunrise to one-half hour before sunset and the commercial lighting meter rate for all power used from one-half hour before sunset to one-half hour after sunrise, subject to a minimum charge of $1.50 per month per horse-power of maximum demand and

subject to a meter rental of $1.00 per month. Minimum term of contract, one year.

4. For alternating-current motors of one horse-power or over, 2 cents per kilowatt hour from 12.00 a. m. (midnight of the previous day) to one-half hour before sunset and the commercial lighting meter rate from one-half hour before sunset to midnight, subject to a minimum charge of $2.50 per month per horse-power of maximum demand and subject to a meter rental of $1.00 per month. Minimum term of contract, one year.

5. For alternating-current motors of five horse-power or over, whose use is restricted to that portion of the year from April 1 to December 1, 2 cents per kilowatt hour, subject to a minimum charge of $2.00 per month per horse-power of maximum demand and subject to a meter rental of 50 cents per month. Minimum term of contract, one season of eight months.

HEATING AND COOKING RATES.

For heating and cooking installations of not less than 1000 watts, including establishments using laundry and tailors' irons, the rates will be the same as the several rates Nos. 2, 3, 4 and 5, under power rates, except that the minimum installation will be 1000 watts for rates Nos. 2, 3 and 4, and 3800 watts for rate No. 5, and the minimum term of contract three months.

The Commercial lighting meter rate hereinbefore referred to is as follows:

For all installations not exceeding 1000 watts, 10 cents per kilowatt hour (1000 watt hours) for the first 30 kilowatt hours used per month, 5 cents per kilowatt hour for the next 60 kilowatt hours used per month, and 2 cents per kilowatt hour for all additional current used. For all installations exceeding 1000 watts there will be charged for each additional 200 watts, or fraction thereof, of installation, an additional 5 kilowatt hours at the rate of 10 cents per kilowatt hour, and an additional 10 kilowatt hours at the rate of 5 cents per kilowatt hour and 2 cents per kilowatt hour for the balance.

22—40. What member companies, if any, give a special rate for primary motors (2200 volts), or in what way do they modify their contract for secondary motors (220 volts) in order to take care of this class of service?

(Also answered in February BULLETIN.)

Ross B. Mateer, The Denver Gas and Electric Company, Denver, Colo.—All primary voltage motors in excess of 25 horse-power operate upon a lower rate than such motors connected on the 220-volt secondary circuit. Where we can meter on the primary, and where no transformers are necessary, it is customary in large installations to give the consumer an additional discount, sufficient to cover the iron and copper transformer losses.

Thomas F. Kelly, Contract Agent, The Hamilton Electric Light and Power Company, Hamilton, Canada.—In Hamilton, all power customers are using 2-phase, 220-volt, 66 2-3-cycle, alternating-current motors. The current to customers with installations less than 50 horse-power is measured on the secondary side of the transformers, that is, at 220 volts; but to all power customers with motors of 50 horse-power and over, the current is measured on the primary side of the transformers, that is, at 2200 volts. Customers with less than 50 horse-power in motors pay from 4 to 1 1-3 cents per kilowatt hour, and customers with 50 horse-power and over pay from 1 1-3 to 9-10 cents per kilowatt hour.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Company, Roanoke, Va.—In installations of 20 horse-power and larger, we have made it a practise to install 2200-volt motors. We make no change in the rate for these two services, that is, low and high voltage motors. The larger user is naturally entitled to low rate, while the small user necessarily pays a higher rate. Our practise has been when a customer is interested in motor drive, that is if his requirements are for large motors, we take him over various installations, showing him the 2200-volt motors in operation and the simplicity of this drive, and we have no trouble whatever in getting this customer to adopt high-voltage motors.

22—48. What plan do member companies follow in charging customers for welding machines, more particularly spot welders, used in place of riveting sheet metal, taking, in one instance, four-kilowatts for 5 seconds. The meter

does not measure the total watts. What fixed charge per month should be on such machines outside of what is charged over the meter?

The Hartford Electric Light Company, R. W. Rollins, General Manager, Hartford, Conn.—The Hartford Electric Light Company has on its system among its large power manufacturing concerns, several electric welders, some of which are for heating pipe for process of bending, others for spot welders. We supply the current for these welders at the same price as for motive power, the entire power consumption being based on our regular schedule of prices. In each case, the percentage of current used for welding purposes to the entire amount consumed is so small as not to be worthy of special consideration.

Thomson Electric Welding Company of Lynn, Mass., forward a catalogue in which the horse-power used in electric welding is tabulated. As this has a bearing on the subject-matter of this question, we reprint the page of the catalogue covering this phase of the subject:

HORSE-POWER USED IN ELECTRIC WELDING.

The power and the time vary nearly as the cross-sectional area.

Within certain limits the greater the power the less the time, and vice versa.

A ¾-inch round can be welded with 15 kilowatts in 15 seconds; with 23 kilowatts in 6 seconds.

Endless pieces, like rings, take more power as the diameter decreases; copper, more power and less time than steel or iron.

To get the best results the pressure of the current should be constant and not drop below the rated number of volts during the time the pieces are heating in the welder.

The following table gives approximate normal power and time for various sections. The time given is for the application of the current only. Multiplying the kilowatt-hours by the number of cents it costs per kilowatt-hour, will give the current cost for 1000 welds.

Iron Steel Ro.	Area	Horse Power	K. W.	Seconds	Approx. K. W. Hrs. 1000 Welds
¼	.05	5	4	2	2
⅜	.11	8	6	3	5
½	.20	12	9	6	15
⅝	.31	16	12	10	30
¾	.44	20	15	15	65
⅞	.60	24	18	18	90
1	.79	26	20	20	113
1⅛	.99	33	25	24	167
1¼	1.23	40	30	33	275
1½	1.77	50	38	40	422
1¾	2.41	64	48	48	640
2	3.14	80	60	60	1000

Charles J. Russell, Philadelphia, Pa.—It is the experience of the Philadelphia Electric Company that welding machines have a very low load factor on account of the instantaneous demand during the actual operation of welding and the interval due to handling the pieces to be welded.

The very best way to handle the welding proposition is by means of a motor generator set, the motor conforming to the customary requirements and the generator conforming to the standard requirements of the manufacturer of the welding machine. Such an installation can be safely treated as an ordinary power proposition of the same capacity. If several machines of the spot-welding type are installed, the generator may be of such a size as to provide for the maximum simultaneous demand and not the total capacity of the machines installed, as in practise the demand for current is not simultaneous.

It has been found impossible to meter current supplied directly to a welding machine, and for this reason it is advisable, if a motor generator set is not installed, to make a flat rate for this service of a fixed charge plus such current as may be metered. The amount of this fixed charge should be based upon regular power rates, estimating the use in kilowatts per month, as can readily

be done in case of automatic machinery doing spot-welding. These machines have a rated output as to number of pieces welded per hour, and the length of current demand is readily determined. With the knowledge as to the number of hours per month the machines are operated, we have all the data necessary to compute a monthly charge.

It is our experience where a welding machine is used for general repair work the monthly bill will not exceed the regular minimum charged for the equivalent capacity of the machine.

Wm. Rawson Collier, Atlanta, Ga.—This company has one welding machine of 4-kilowatt capacity on the line for the past three years. During this period, although the welder is used regularly, the meter has shown a consumption of only —— kilowatts. Our minimum monthly guarantee is $6.50 net, and this is the amount of the monthly bill.

A. E. Walden, The Baltimore County Water and Electric Company, Baltimore, Md.—We have a minimum charge of $10 per month on such a spot welder and it requires apparently a 15-kilowatt transformer to operate satisfactorily, though the test indications were that a smaller transformer would answer every purpose. One welding machine in the writer's experience required, for from one to three minutes, 200 to 250 amperes at 300 volts, with a power-factor of a little over 50, which may vary, however. The welder transformer had a rated capacity of 40 kilowatts.

22—46. What is approximately the average charge per pair of flaming arcs (commercial lighting) in cities which make special rates for this class of lighting? I believe that we have been selling this light at a price lower than we can take care of these lamps, and I would be very glad to know what others are receiving for such service.

Frederick F. Kellogg, Assistant Contract Agent, The Allegheny County Light Company, Pittsburgh, Pa.—We operate flaming arc lamps on a flate-rate basis of $9 per month, under a contract which provides that the customer shall burn the lamp from dusk to midnight each night, Sundays excepted, and under which we supply the current, loan the lamp and renew the carbons.

For additional hours of burning, etc., we charge a proportionate rate in addition to the regular rate of $9 per month.

Ross B. Mateer, Power Expert, Denver Gas and Electric Company, Denver, Colo.—Each flaming arc burning to midnight is subject to a flat rate of $10 per month; all night, $15 per month. This is only on a year's contract. The carbons for lamps are furnished by the consumer, though the lamp will be trimmed by us.

A. G. Rakestraw, Harrisburg, Pa.—A fair charge for flamers is from $9 to $10 each per month, burning from dusk to midnight, with lamp, current, carbons, trimming and patrolling furnished by the central station.

22—47. Wanted: Information from member companies regarding the amount spent by the cities in which they are located per square mile for street-lighting service. In other words, I wish the result obtained by dividing the number of square miles in the city by the yearly appropriation for street lights.

Thomas F. Kelly, Contract Agent, The Hamilton Electric Light and Power Company, Hamilton, Canada.—The City Corporation of Hamilton, Canada, is paying us $4,400.27 per square mile per year for street lighting.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—Approximately $3,935 per year.

United Electric Light Company, W. L. Mulligan, Manager, Springfield, Mass. —It requires about $6,400 per square mile to light the streets in this city.

D. T. Campbell, Manager, Scranton Electric Company, Scranton, Pa.—$2,800.

E. C. Scobell, Assistant Auditor, Rochester Railway and Light Company, Rochester, N. Y.—Appropriation for the year 1911 in Rochester is $257,000. There are 17.4 square miles available for habitation, or $14,770.11 per square mile for street lighting.

I. B. Zimman, Contract Agent, Omaha Electric Light and Power Company, Omaha, Neb.—*For electric light* our city spends approximately $3,000 per square *mile per annum.*

The United Illuminating Company, New Haven, Conn.—In this city the expenditure per square mile is equivalent to $6,066 for electric, and $3,487 for gas.

R. S. Orr, General Superintendent, The Allegheny County Light Company, Pittsburgh, Pa.—The old city of Pittsburgh, which we light, has an area of forty-one square miles. The amount of money spent this year for lighting by electricity, is $325,000 or $7,927 per square mile.

In addition to the arc and tungsten street lighting there is considerable lighting of unimportant streets and alleys by means of Welsbach lamps. The amount of money spent for this purpose I do not know.

Buffalo General Electric Company, Buffalo, N. Y.—For the year ending June 30, 1910, this city spent $7,630 per square mile for street and park lighting. About 55 per cent of this was for electric and the balance for gas lighting. This is at the rate of seventy-six cents per capita.

Arthur B. Lisle, General Manager, Narragansett Electric Lighting Company, Providence, R. I.—In one municipality which we serve, with an area of 16.2 square miles and a population of 225,000, the amount paid us for street lights is $15,493 per square mile.

In some small municipalities the figures are as follows:

Population	Area	Amount per Sq. Mile
15,800	14.2	$900
21,000	28.8	445
8,500	9.7	630
6,500	6.5	750
2,500	9.3	278
26,600	44.3	381

C. L. Edgar, President, The Edison Electric Illuminating Company, Boston, Mass.

CITY OF BOSTON DURING TWELVE MONTHS,
December 10, 1909—December 10, 1910.

Number of square miles in Boston	38.66
Amount paid for arc street lighting	$386,485.76
" " " incandescent street lighting	22,414.08
" " " gas street lighting	277,322.78
" " " naphtha street lighting	1,833.28
Total	$688,055.90
Expenditure per square mile	17,797.61

J. F. Dostal, Superintendent Electric Department, The Denver Gas and Electric Company, Denver, Colo.—For the year 1910 the city and county of Denver paid a total of $165,791.51 for street lighting, divided as follows:

Arc lights	$139,106.25
Fifty c.p. lamps in suburban districts	21,306.63
Boulevard lighting (50 c.p. Tung.)	5,378.63

The area within the corporate limits of the city is 59.25 square miles making the total outlay for lighting per square mile $2,802.

There is not a single street gas lamp in operation in the city of Denver, all street lighting being done by electricity.

22—48. When signing on a demand basis, do any companies sign up tungsten lamps on a candle-power basis?

Ross B. Mateer, Power Expert, Denver Gas and Electric Company, Denver, Colo.—When signing on a demand or connected load basis tungsten lamps are figured on a candle-power basis, or the equivalent in 16 candle-power lamps.

Wm. Rawson Collier, Atlanta, Ga.—My opinion is that tungsten lamps should be rated according to their wattage if the custom of the company is to place the demand on the basis of the 16 candle-power equivalent (carbon).

A. G. Rakestraw, Harrisburg, Pa.—We sign all demand contracts on a watt basis and restrict the user to tungsten lamps.

L. W. Layman, Rochester, N. Y.—See *Electrical World*, March 2, 1911, page 520.

22—49. Do any companies furnish free tungsten lamps and transformers on flat-rate sign contracts?

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—Our rates for signs furnished by the company are so figured that the company supplies the 4 candle-power tungsten lamps and transformers for same. Should any customer desire to change from 2 candle-power carbon lamps to 4 candle-power tungsten lamps, we make the change and charge for lamps and transformers.

Ross B. Mateer, Power Expert, Denver Gas and Electric Company, Denver, Colo.—On a long-term contract for a large, flat-rate installation, free tungsten lamps and transformers are occasionally furnished to the consumer.

W. P. Guinan, Empire District Electric Company, Joplin, Mo.—On flat-rate sign contracts this company furnishes the first installation of tungsten sign lamps, and renewals, for the life of the contract, and also furnishes sign transformer, which always remains the property of the company.

MANAGEMENT

23—21. Wanted: Information or recent data relative to the cost on which electric companies base their minimum charges; that is, figures giving general information as to the stand-by or investment cost per kilowatt along the lines of, say, one hundred dollars per kilowatt for station equipment, and then certain figures for overhead line construction, and certain other figures for underground construction per kilowatt capacity, etc.

(Other replies in January and February BULLETINS.)

F. J. Petura, of Henry L. Doherty and Company, New York.—The minimum charges in the company referred to below are based, to a large extent, on the "Readiness-to-Serve" rate.

In the following, it is assumed that the station investment is $100 per kilowatt; distribution system $70 per kilowatt; and consumers' equipment $30 per kilowatt; interest on the funded and floating debt at the average rate of 5½ per cent; depreciation and obsolescense, 5 per cent on the station; 7 per cent on the distribution system; and 7 per cent on the consumers' equipment.

The costs of the fixed charges on the Readiness-to-Serve basis are then:

DEMAND.

Operation	$14.90	per KW. per yr.
Interest	3.65	" " " "
Depreciation and Obsolescense	3.55	" " " "
Total	$22.10	" " " "

CONSUMERS.

Operation	$4.30	per consumer per yr.
Interest	1.56	" " " "
Depreciation and Obsolescense	2.00	" " " "
Total	$7.86	" " " "

23—22. What is the best method of keeping customers' accounts, by cards or loose-leaf ledger, and why?

(Other replies in February BULLETIN.)

C. G. Keeler, Head Bookkeeper, Denver Gas and Electric Company, Denver, Colo.—With a large growing population, it is hard to conceive any system superior to the loose-leaf ledger for the handling of gas and electric accounts, especially where the accounts are continually being referred to by the clerks,

credit men and solicitors. In taking off a comparison, or report of any kind, the loose-leaf ledger-sheet will be found very handy. The ledger-sheet used by this company is ruled and spaced to carry all data required for two years. It would not be practical to use cards the size of our ledger-sheet, which is 11 x 20.

28—25. What is the average revenue obtained by member companies on electric irons, toasters and sewing-machine motors?

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—Electric irons, toasters and sewing-machine motors will average, in use, net revenue of 20 cents each per month. This figure, we believe, is a little low and should be nearer 25 cents than 20 cents.

Ross B. Mateer, Power Expert, Denver Gas and Electric Company, Denver, Colo.—Electric irons, 50 cents; toasters, 35 cents; sewing-machine motors, 25 cents. All per month.

Wm. Rawson Collier, Atlanta, Ga.—The average (estimated) income from electric irons in this city is thirty cents per month. We have no figures on toasters or sewing-machine motors.

Eugene Creed, Sales Manager, The Toronto Electric Light Company, Toronto, Canada.—Revenue on electric irons, about six dollars per year: toasters, twenty-five cents per week.

W. P. Guinan, Empire District Electric Company, Joplin, Missouri.—This company estimates the average revenue on electric irons and toasters used in residences at $6 per year.

28—26. Wanted: Information from member companies as to what use they make of the Hollerith System in addition to recording and analyzing earnings.

H. C. Schlegel, The New York Edison Company.—This company installed the Hollerith System in August, 1903. The uses of this system are:

1. To total the amounts of monthly consumption of current;
2. To total the amounts of bills rendered;
3. To total the number of meters upon which bills have been rendered;
4. Total monthly amounts rendered on each and every ledger sub-divided into totals for each 100 folios, thereby expediting the balancing of ledgers at the end of each month;
5. To get an analysis showing:
   (a) Monthly consumption of current;
   (b) Monthly amount of bills rendered under various rates at which current is sold;
   (c) Percentage that each rate bears to the total amount of bills rendered;
   (d) Average price of income per kilowatt hour under each rate;
   (e) Percentage of increase over the corresponding months of previous year;
   (f) Percentage of increase for the number of elapsed months during the year.

This system has also been of great value in obtaining data which enabled us to ascertain the effect of various new rates suggested from time to time upon the present income.

We are also obtaining statistical data through this system which enables us to ascertain:

1. Length of service of each individual employe;
2. Average length of service of all employes;
3. Amount of wages paid;
4. Rate of pay, either hourly, daily, weekly or monthly, and yearly average;
5. Age of each individual employe.
6. Average age of all employes in the company;
7. The above information may be given for each individual department.

We also obtain a classification showing:

1. Amount of bad debts divided into the various nature of businesses, etc.;
2. Amount of loss occasioned through failure, etc.;

3. Number of cases on which allowances are made;
4. Total amount allowed for fast meters, creeping meters, errors, etc.

In conclusion, I might add that the uses to which this system may be put are almost limitless.

L. M. Wallace, Auditor, Boston, Mass.—In compiling earnings statistics the Hollerith tabulating outfit performs correctly that which eight to ten clerks could not do so satisfactorily in long hand. We are considering its possible use also in connection with the expense statistics.

E. J. Allegaert, Public Service Electric Company, Newark, N. J.—We are just installing the system for general statistical information.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—We do not use the Hollerith System for any purpose except the recording and analyzing of the company's earnings.

B. F. McGuire, Commonwealth Edison Company, Chicago, Ill.—The Hollerith System, in addition to recording and analyzing service meter output and income, is used by our company to check the customer's bill before it is posted or sent out to the customer.

The checking is done by sorting the cards according to rate class, getting all the cards figured at the same rate together. The total kilowatt hours for any rate class multiplied by the rate should give the total net bill if all the bills have been extended correctly. In addition to checking the extension before sending bill to customer, we are checking our Hollerith cards for statistical purposes.

22—27. In companies of 10,000 or more customers, how many monthly accounts are assigned to one bookkeeper?

Edwin A. Barrows, Treasurer, Narragansett Electric Lighting Company, Providence, R. I.—At the present time our bookkeepers are taking care of approximately 2000 accounts each.

H. C. Schlegel, New York Edison Company.—From 2000 to 2500 accounts are assigned to a bookkeeper.

W. T. Nolan, Chief Clerk, Rochester Railway and Light Company, Rochester, N. Y.—Our bookkeepers who keep the electric accounts take care of about 2500 accounts each, and do all the work in connection with such accounts—that is, billing, posting, balancing, etc.

L. A. Coleman, The United Electric Light and Power Company, New York.—Our bookkeepers handle an average of 2500 accounts each.

L. M. Wallace, Auditor, Boston, Mass.—The number of accounts assigned to any one bookkeeper is determined by the capacity and ability of the employe, a junior bookkeeper (receiving the minimum salary), handling approximately 4000 accounts, while the more experienced and efficient bookkeeper (receiving the maximum salary) is now handling approximately 6000 accounts.

E. J. Allegaert, Public Service Electric Company, Newark, N. J.—About three thousand.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—Our bookkeepers handle from 5000 to 8300 accounts, according to the class of work involved on the bills. This does not refer to a single bookkeeper, but to crews who handle the billing by districts. A crew of one bookkeeper and two or three young assistants handle approximately 6500 accounts.

E. E. Stigall, Chief Clerk, Kansas City Electric Light Company, Kansas City, Mo.—In the customers' accounting department of this company we are assigning about 1500 business accounts to one bookkeeper and about 2000 residence accounts to one bookkeeper. A rate schedule based on varying discounts for commercial service justifies more time per commercial customer.

F. J. McCormack, Edison Electric Illuminating Company, Brooklyn, N. Y.—Our bookkeepers average 2500 accounts in addition to their other regular routine work.

George E. Burns, Assistant Treasurer, Commonwealth Edison Company, Chicago, Ill.—Each bookkeeper takes care of approximately 5000 accounts.

23—28. Do any member companies of 10,000 customers or more assign the billing and bookkeeping in connection with customers' accounts to one employe, or do they have separate bill clerks and bookkeepers?

Edwin A. Barrows, Treasurer, Narragansett Electric Lighting Company, Providence, R. I.—The billing and bookkeeping, in connection with customers' accounts, is not done by one employe. We employ separate clerks to figure the bills and to work on the ledgers.

H. C. Schlegel, The New York Edison Company.—Bills are rendered and computed by a separate force of bill clerks and checked by bookkeeper against separate extension of bills made in the ledger. This gives a check as to the correct figuring and rendering of bill.

W. T. Nolan, Chief Clerk, Rochester Railway and Light Company, Rochester, N. Y.—We do not have separate billing clerks and bookkeepers—one clerk doing the billing and bookkeeping, as stated in answer to question 23—27.

L. A. Coleman, The United Electric Light and Power Company, New York.—Both our billing and bookkeeping are done by the one man.

L. M. Wallace, Auditor, Boston, Mass.—All billing is performed by junior clerks who are especially engaged for and assigned to this class of work. Bookkeepers perform all work in connection with the accounts receivable ledgers—making the debit and credit postings, preparing statements of accounts and supplying the collection department with such information as it requires in connection with the collection of accounts.

E. J. Allegaert, Public Service Electric Company, Newark, N. J.—Separate bill clerks and bookkeepers.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—The bills are made up in the meter department and then transmitted to the accounting department. The extension is made on the bills by the meter department covering the base rate. The discounts and net amount are computed by the accounting department.

E. E. Stigall, Chief Clerk, Kansas City Electric Light Company, Kansas City, Mo.—At the present time this company does not have a billing department separate from the bookkeeping department, such system having been discarded after an unsatisfactory experience with same. We find the consolidation of the meter record, billing and bookkeeping departments very satisfactory. Monthly readings are reported on single monthly reading slips direct to the different bookkeepers. The customers' ledger shows the reading, date and units consumed, as well as all debits and credits. The readings are entered on the ledger by an assistant bookkeeper, who also copies the reading, together with the previous reading, on to the bill, making no extension other than the increase during the period. All other work in connection with ledgers and bills, such as ledger extensions, cash postings, monthly balances, delinquent reports, and the extensions on monthly bills, is done by the regular bookkeeper. Extensions on bills, however, are made by a bookkeeper not in charge of the ledger containing these accounts. In this way, there is a check against a mistake being made on the ledger extensions; and a similar check is made on all other work in the department, such as opening of new accounts, final bills rendered on disconnection service, and other detail work necessary on the customers' accounts.

F. J. McCormack, Edison Electric Illuminating Company, Brooklyn, N. Y.—Our Accounts Receivable Bureau is divided into twelve geographical districts. To each district is assigned a separate bill clerk and a separate bookkeeper.

George E. Burns, Assistant Treasurer, Commonwealth Edison Company, Chicago, Ill.—Billing and bookkeeping departments are entirely separate.

C. E. Brenton, Auditor, Union Electric Light and Power Company, St. Louis, Mo.—All work in connection with the customers' accounts, except the collection of extra bad accounts, are handled under one employe.

Sundry charges for appliances, wiring, etc., are handled by the same set of clerks.

23—29. Do companies with 5000 or more customers, in their compilation of connection reports, include as "connections" sales of cooking and heating appliances?

Edwin A. Barrows, Treasurer, Narragansett Electric Lighting Company, Providence, R. I.—On our monthly report of connections or connection load, every class of service is included under its proper heading, the cooking and heating appliances being kept track of and tabulated as such.

H. C. Schlegel, The New York Edison Company.—It is the practise in this company to include cooking and heating appliances in the compilation of connection reports.

W. T. Nolan, Chief Clerk, Rochester Railway and Light Company, Rochester, N. Y.—We keep a record of all cooking and heating appliances connected to our lines, and they are classified under "Miscellaneous Appliances."

L. A. Coleman, The United Electric Light and Power Company, New York. —We do not include in our "connections" small cooking and heating appliances.

E. J. Allegaert, Member Accounting Committee, Public Service Electric Company, Newark, N. J.—Not at the present time.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—We do not include cooking and heating appliances in connected load record if they are used in the socket or receptacle from which a lamp has been removed temporarily.

If a special receptacle is provided for such an appliance so that it is to be used independent of the lighting installation, then it is included in our record and brought into one division of our incandescent lamp record, known as "Miscellaneous Lamp Apparatus Classed as Lamps," and is recorded in total watts, subsequently changed to 50-watt lamp equivalents.

These appliances, in either case, do not figure in our discount factor or minimum charge, but in all cases an accurate record is kept of such apparatus for general information purposes as may be required for future reference.

Thomas F. Kelly, Contract Agent, The Hamilton Electric Light and Power Company, Hamilton, Canada.—We do not include in our connection report sales of cooking and heating appliances as "connections." The sale of such appliances is taken care of by separate reports.

Wm. Rawson Collier, Atlanta, Ga.—Here, a special report is made covering cooking and heating appliances. Unless covered by special contract, these appliances are not included in the connected load record.

Eugene Creed, Sales Manager, The Toronto Electric Light Company, Toronto, Canada.—The company with which the writer is connected includes cooking and heating appliances as old or additional business. Of course, if a service is run to a new customer to supply electric heating apparatus, it would be called a connection.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Company, Roanoke, Va.—All cooking and heating appliances, as well as irons, are figured in on our connected load reports where we are able to get this record. Of course, all sales through this office are reported, yet we have found it impossible to get an actual report on sales made by contractors and dealers.

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—The Kansas City Electric Light Company, in compiling data for connected load, includes the wattage of all cooking and heating appliances and all other electrical apparatus which are current-consuming devices. This data is compiled from the charge sales, credit sales and cash sale sheets. The connected load is inversely credited with any appliances returned from customers, so that our connected load record shows approximately the total kilowatts of electrical appliances connected to the system.

J. W. Cowles, Boston, Mass.—No cooking, heating, or special appliances are included in connected load records if they are connected to sockets interchangeable with incandescent lamps, but any such apparatus permanently installed without reference to lamp sockets, is added to the load records. The interchangeable interpretation is only applied to apparatus of less than 600 watts rating, it being assumed that anything above this rating will be permanently connected, independent of lamp sockets.

E. R. Davenport, Sales Manager, Narragansett Electric Lighting Company, Providence, R. I.—This company does.

Commonwealth Edison Company, H. Wright, Chief Clerk, Contract Department, Chicago, Ill.—If a separate meter is installed for a customer for this class of service, the amount of business so connected is placed upon the records in the contract department. Additional loads of small heating appliances, which are not additional to a power meter, are not made a part of the connected business.

C. E. Brenton, Auditor, Union Electric Light and Power Company, St. Louis, Mo.—This company does include in its connection reports cooking and heating appliances installed on the lines, for the reason that it wishes to know how heavily its circuits are loaded, but it does not include the capacity of appliances in figuring the customers' connected load upon which the schedule of rates is based, because it wishes to augment the use of electricity in this class of business.

24—38. Would it pay a company with a night load only, and a revenue of less than $900 a month, to install duplicate machinery to guard against shutdowns?

(Also answered in December BULLETIN.)

W. L. Abbott, Operating Engineer, Commonwealth Edison Company, Chicago, Ill.—In general, any lighting plant should have its generating power in more than one unit (preferably, three or four), not all of which will be required at all hours of the day or night, and during such times those units which are standing idle will be reserved for those which are carrying a load; but in case of a plant so small that its monthly revenue is only $900, the power required would be so small that it would be absurd to consider splitting it up among two units or more, and as a reserve of 100 per cent in generating capacity would be a prohibitive tax upon any lighting company, the answer to the question is "No."

24—43. Where company regularly inspect signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat-rate outline and sign work, where competitive electric lighting companies are in the same field?

E. J. Fowler, Statistician, Commonwealth Edison Company, Chicago, Ill.—We do not at the present time inspect or take care of lamps used in outline lighting by our customers.

The cost to us for inspecting, cleaning and relamping signs is 9 cents per lamp per year. While it is possible that the increased current consumption might not pay the extra cost, our sign proposition is made much more attractive by giving this service and keeping our signs up in first-class shape than it would be if the same were left in the hands of the customers, and we think this feature has a whole lot to do with developing and holding this important branch of our business.

J. E. Harsh, Commercial Manager, The Empire District Electric Company, Joplin, Mo.—With this company, the labor expense covering renewals and inspection on signs and outlines figure about 1¾ cents per lamp per year, 95 per cent of our signs and outlines being on "dusk to midnight" flat rate. It would seem most advisable to closely inspect this class of business under either flat or meter conditions. In case lamp renewals are not furnished where displays are on meter, it is advisable to make every effort towards inducing the owner to regularly replace his burned-out lamps.

There are several reasons why a central station should carefully look after display renewals, one important one being that display advertising containing a number of burned-out lamps presents a very poor appearance, particularly to the prospective sign purchaser. Again, it is not through the sale of display lighting that the central station obtains its profit, but through continuous use of it. To procure this continued use, the central station must keep the purchaser pleased with his investment, hence it is important that the display is always kept at its best.

24—45. What member companies have discontinued the free sign proposition? Please state reasons.

(Also answered in February BULLETIN.)

G. T. Coggswell, Montgomery Light and Water Power Company, Montgomery, Ala.—We find that we have been able to sell more electric signs than we were able to give away. "Something for nothing" cheapens the article.

Ross B. Mateer, The Denver Gas and Electric Company, Denver, Colo.—In the early days of our sign campaign a few were furnished free. This practise was discontinued and no two signs will now be alike in design. The consumer who can afford a sign is well able to pay for its construction.

24—46. Since the recent hearing before the Interstate Commerce Commission, the papers and magazines have been full of the doctrine of efficiency or scientific management, implying, in general, that in many cases by scientific planning, employes as individuals and the organization as a whole, can accomplish more work with less expenditure of time and effort, thereby enabling individual wages to be increased, and yet a saving effected to the corporation.

Assuming for the sake of argument that scientific management, so-called, can accomplish a large part of what is claimed for it in industrial establishments, and even in railroads, is there any opportunity to effect a similar saving in electric light and power companies?

John C. Parker, Rochester, N. Y.—The writer's personal feeling is that a public utility company, which, in the nature of things, has to deal very largely in matters of public policy, cannot go so far in the matter of standardizing methods and men as can a manufacturing plant working under the Taylor system. "Scientific management" might reduce to a minimum the management, engineering, and commercial expense per kilowatt-hour, and at the same time, through the creation of lack of sympathy with the general public, reduce the kilowatt-hours sold to such an extent that the aggregate profits to the concern would really diminish. There is no method that the writer knows of whereby the feeling of sympathy between the public and, say, the superintendent of a public service corporation, can be measured and prorated to his hours of operation. The same condition extends to the subordinate employes of the company.

As an illustration, under "scientific management" a telephone clerk might be taught to answer a maximum number of calls per day, and yet in the process might become so perfunctory and so devoid of the human touch, as to fail to establish a warm sense of personal relationship between the customer and the corporation. Without this feeling the corporation's best asset in the community would be lost, and yet the efficiency of the telephone clerk would appear on the books to be very high.

It is very hard to estimate the effect on spontaneous and enthusiastic service to both the corporation and the public produced by the disgruntled feelings of employes who are too closely tied to the time clock and an exact tab on their movements kept while in the office.

The writer believes thoroughly in efficiency engineering when applied to standard production, but feels that public service corporation work demands a maximum of breadth consistent with definite efficiency on the part of each employe, since the relationships in which any employe will stand to the clientele of a public service corporation are so highly various in kind.

24—47. What have member companies found to be the best method of handling free lamp renewals, by periodic renewals or by request renewals?

Do member companies renew the lamps in the socket, or do they deliver them to the door and exchange for the old lamps and let the consumers put them in the sockets, or does the representative of the company go through the house and renew them?

Do member companies consider it a good practise to go through the houses? If so, why? If not so, why?

What is the object of periodic lamp renewals?

A. G. Strickrott, Schenectady Illuminating Company, Schenectady, N. Y.—A combination of both, in addition to a conveniently located lamp renewal depot, preferably at the office of the company. The latter affords opportunity for customers to exchange their lamps at any time when necessary and convenient to themselves. The request system gives them the benefit of a delivery service, arranged as the number of calls may warrant to effect advantageous and economical operation to the company. Our regular days for making

request renewals are Wednesdays and Saturdays of each week and if necessary we add an extra day. The periodic system fills in the other days to serve such customers who neglect their installations and make only burn-out renewals. With our equipment, consisting of a 1000 lb. electric truck and two men, we find it possible to make semi-annual inspections of all lighting customers (numbering about 10,500) in addition to handling request renewals. On request days only one man is employed on this work, the other being used to good advantage in the lamp-testing room.

Our men make the changes in the sockets, except those in fancy fixtures or where the use of a ladder is required. This is advantageous inasmuch as our men can look over all the lamps and change only those blackened or burned out. They can also make suggestions as to the size of lamp which should be used, also shades and reflectors which would improve the lighting conditions, etc. This also affords an excellent opportunity to introduce small tungsten lamps for residence lighting.

The object of making periodic renewals, as we see it, is to keep customers supplied with good lamps for our own benefit, maintain a satisfactory lighting service for the customer's benefit, show that we take an interest in customer's welfare, and through this efficient service and attention induce the further use of current by the addition of irons and other appliances which may be connected to the lighting service. This also offers an excellent opportunity to distribute literature and advertising matter pertaining to new devices, etc. The fact that we have sold 372 irons during the past summer direct from our lamp wagon by the lamp men, who had no experience as salesmen or solicitors, and handled this along with their regular work, is evidence that this purpose is being accomplished to some extent.

[Mr. Strickrott presented before the St. Louis Convention an interesting paper on this subject, entitled "Periodic Lamp Renewal and Customers' Service Inspection." It will be found on pages 114-250 of Vol. I, of the "Proceedings." —Editor.]

Wm. Rawson Collier, Atlanta, Ga.—This company makes all its renewals by request. We renew the lamps in the socket except in the cases of some large office buildings and hotels. In the case of residences, the lamp renewal man goes all through the house and renews the lamps.

The main objection to periodic renewals is, that lamps are liable to burn out soon after the renewal man has made his tour. These lamps would then have to remain dead until the next renewal period. This means loss of revenue to the company and discomfort to the customer.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Company, Roanoke, Va.—This company furnishes free lamp renewals. They are exchanged at our office. However, in many instances where requests are made for inspection, we send out an inspector and change the lamps and get the installation in first-class condition. We believe that periodical inspection is really necessary. No doubt throughout the residential section there are lamps in use to-day giving one-half of their original candle-power, the customer not taking the trouble to bring in the lamps and make the exchange. This inspection would impress the consumers with the fact that the company is looking after their service and that each and every customer is getting the best service possible.

A. G. Rakestraw, Harrisburg, Pa.—I think the best method is to renew all lamps in every house about once per year, filling up all the empty sockets. The lamps brought in are then assorted according to candle-power into new, second grade and useless lamps. If customers require lamps between visits, they should bring burned-out lamps to the office for exchange. The lamp renewal men should go through the houses and personally change all the lamps. This is the only sure method of avoiding complaints. When one customer moves out and another comes in, there need not usually be new lamps furnished unless upon request.

24—49. Do member companies allow vacations to all employes, and, if so, what length of time is allowed to different grades of employes, i. e., does a long term of service entitle an employe to a greater vacation than a short term?

E. A. Edkins, Superintendent Employment Bureau, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company's general practise with reference to vacations is as follows: Those employes who have been on the monthly payroll six months or longer may be allowed a vacation of one week, and those who have been on the monthly payroll for a year or longer may be allowed a vacation of two weeks. Employes on the weekly payroll may be granted a limited leave of absence on their own time.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—All employes who are rated by the month, and who have been in the employ of the company on or prior to September 1st of the preceding year, are granted two weeks' vacation each year, with pay. There is no distinction made as to the length of service, other than the following:

Employes engaged between September 1st and December 31st, are granted one week's vacation during the calendar year following the date of employment. Employes engaged between January 1st and April 30th, are granted three days' vacation during the first calendar year of their employment.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—All salaried employes are allowed a two weeks' vacation, with pay, after having served the company for six months. Six-day linemen are paid for time and one-half for extra work and are not allowed a vacation. All seven-day men are paid time and one-half for extra work and are given two weeks' vacation with pay. Installation department men are paid straight time for extra work and are allowed one week's vacation with pay. Length of time in service of the company does not affect the term of vacation.

M. S. Seelman, Jr., Brooklyn, N. Y.—In general, employes are divided into two classes:

First, those whose term of service with the company exceeds one year on May 1st, and

Second, those whose term of service has been less than one year on that date.

For clerks, office help, and the higher class of responsible employes in the operating and distribution departments, two weeks' vacation is given to those in the first class, and to those in the second class, one day for each month of service. Other employes receive from three to ten days' vacation, in accordance with a well-defined classification, issued as a general order of the company.

Rochester Railway and Light Company, Rochester, N. Y.—We do not allow vacations to all employes. In the case of office employes, one year of service entitles the employe to a two weeks' vacation. Vacations are allowed to some other employes as they are warranted by faithful service, but are not a regularly recognized thing.

24—50. Do member companies with 5,000 or more customers, who supply free carbon lamps and renewals, start each new account with a new outfit of lamps, or in case of "succeeding" customers, does the new account simply fall heir to the lamps of the old customer and start that way? In other words, does the company, of its own volition, start every new customer with a new outfit of lamps, or does it simply fill up empty sockets, or does it wait till the new "succeeding" customer demands lamps?

C. C. Paver, Superintendent Lamp Renewals, Commonwealth Edison Company, Chicago, Ill.—All initial installations are supplied with a new lamp for each socket at the time that the meter is set. In case of successors where we find empty sockets we fill up all sockets with new lamps, taking consumer's receipt for complete equipment. Old lamps left in sockets by predecessor are renewed by wagon upon request either by the repair department or consumer.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—New consumers pay for the first installation of lamps; after which, standard type lamps are renewed free of charge. In the case of "succeeding" consumers, the new accounts fall heir to the lamps of the old consumers. A recount and inspection of the installation is made and renewals given where necessary. Missing or broken lamps are replaced at the new consumer's expense.

C. F. Farley, Manager Light Contract Department, Kansas City Electric Light Company, Kansas City, Mo.—Our method of handling carbon lamps requires the consumer to post a deposit of 25 cents for each 4, 8, 16 or 32 candle-power carbon lamp obtained from the company. This deposit is held until consumer discontinues the service and lamps are returned to the company's office. All lamps broken or unaccounted for are paid for from this deposit at the rate of 25 cents each. Under this system no lamps are transferred from one consumer to another.

Wm. Rawson Collier, Atlanta, Ga.—When a customer discontinues the use of electricity all lamps are removed and the next customer obtains an entirely new installation of lamps. In the case of a transfer without a total cut-out, the new customer simply takes the lamps of the old customer and the company fills up empty sockets, charging these lamps to "installations."

F. T. Williams, Sales and Contract Agent, Roanoke Railway & Electric Company, Roanoke, Va.—In case of a "succeeding" customer, the workman goes over the entire installation, takes out all burned out and blackened lamps, supplying new lamps in their stead. He goes over the installation with the customer and advises him as to the proper size to be installed. It is hardly advisable to furnish larger lamps than are really necessary, as it is essential to keep the customer's bills within certain limits and to keep him satisfied.

In cases where the service is discontinued on account of the party moving, all lamps are removed, and when an application is made for service at this point, new lamps are furnished.

J. W. Cowles, Boston, Mass.—Every new customer is started with a thoroughly good outfit of lamps. In the case of a "succeeding" customer, all lamps which are old or questionable are replaced, but those which are clearly good and suitable for service are allowed to remain. The "succeeding" customer is not allowed to suffer by falling heir to old lamps which may reduce the quality of service.

C. S. Shepard, Controller, New York Edison Company.—New York Edison practise with a given incandescent lamp installation and a change of customer is to send to new customer and ask him if he wants all the lamps changed, or if we shall light the lamps and change defective lamps. Customer's word determines.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—In new service installations we collect cash for lamps required. In the case of a new customer on an old service we renew a limited number of burned-out or inefficient lamps. If old customer, in vacating, takes lamps with him, we collect for lamps delivered to new customer.

E. R. Davenport, Sales Manager, Narragansett Electric Lighting Company, Providence, R. I.—In the case of succeeding customers this company does not furnish new lamps, except upon request. Any empty sockets at such time are filled upon notification with new lamps.

24—51. How do companies who house 100 or more employes under one roof handle the matter of their employes' clothing, especially in the winter season? Are lockers provided, and, if so, how many employes per locker? Does any company maintain a room for checking employes' clothing. Would such an arrangement be feasible?

E. A. Edkins, Superintendent Employment Bureau, Commonwealth Edison Company, Chicago, Ill.—In all the Commonwealth Edison Company's larger departments and in the generating plants and sub-stations steel lockers are provided for the use of employes. With very few exceptions each employe has the exclusive use of a locker. At the Fisk and Quarry Street stations the men are required to provide their own padlocks. This was necessitated by numerous complaints received from the men to the effect that their lockers were being forced open and money, etc., stolen from their clothing. Since requiring them to provide their own padlocks for each locker these complaints have entirely ceased. We do not maintain a room for checking employes' clothing; neither do we believe that such an arrangement would be as satisfactory as the use of the steel lockers.

The Philadelphia Electric Company, Joseph D. Israel, District Manager, Philadelphia, Pa.—We provide individual lockers for the employes.

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—The Kansas City Electric Light Company provides a cloak room for its office employes, where all hats, wraps, umbrellas, etc., are checked. It is large, well ventilated, equipped with standard racks and in charge of a cloak-room boy. At the present time the cloak room has accommodations for 134 people with sufficient space to provide for 300 ultimately. The arrangement is very satisfactory to both the employes and the company inasmuch as it provides a safe place for keeping employes' wraps and eliminates the liability of articles being stolen from the lockers, as we experienced before cloak room was provided.

Joseph Williams, Treasurer, New York Edison Company.—A cloak room would be most desirable if the requisite space could be secured, which does not seem possible in a crowded office building.

In large department stores, it is my impression that they have such a room, but generally down in the basement. The system in this building is for each department to allow sufficient space for the lockers of their own people, assigning two people to each locker. This, generally speaking, gives ample room for an overcoat, hat and at times overshoes for the occupants, but for the women employes, with the present style of headgear, almost any locker for them is out of the question. Their lockers are maintained in the rest rooms, and any hat too large for the locker is placed on top. The lockers, of course, are provided by the company.

C. E. White, Brooklyn, N. Y.—Separate locker rooms are provided for male and female employes. In all cases separate locker is provided for each employe.

Rochester Railway and Light Company, Rochester, N. Y.—Locker arrangements are made for all indoor employes. A checking system would necessitate having a man or boy in charge, and it would seem to be a cheaper arrangement to provide a locker for each man, and let the first expense be the entire cost.

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

W. G. Claytor, Electrical Engineer, Roanoke Railway and Electric Company, Roanoke, Va.—This company was sued for $10,000 damages about a year ago for the death of a small boy, caused by an electric shock, due to the child throwing a piece of bale hay wire over the arc lamp leads of a fifty-light circuit. Suit of the plaintiff was based on the fact that had the insulation not been defective, the child would not have been killed. We proved that the ordinary insulation on weatherproof wire deteriorates very rapidly when exposed to the elements, and that it was not due to our negligence that the accident happened.

25—10. What states have statutes giving the right of eminent domain to power generating and transmission companies for pole lines? Is there available a pamphlet or book containing copies of all existing statutes covering this point?

J. R. McKee, Chairman Sales Committee, General Electric Company, Schenectady, N. Y.—You can get a very extended variety of opinions on this subject in proportion to the number of lawyers you consult. It is an extremely live issue all over the United States at present and a very much unsettled one.

Generally speaking, it has been advised that where you are a public utility you can condemn the right of way for a pole line. If you own your own central power station, steam or water-power, and also the same company owns the public utility, such as lighting or street car system, it is regarded as a more simple problem than though you are a power-generating station and endeavoring to sell power to a public utility.

I have seen legal advice in New York State that the right of condemnation for pole lines would apply under both the above situations. Whether it would apply in other states, of course, is something that would have to be decided by an attorney familiar with the laws of the respective states in which it is desired to operate. I have not seen any favorable opinion as yet as to the rights of condemnation of a power company for the transmission of power for other than public utilities.

[While not a direct answer to the above inquiry, there is an interesting construction and discussion in reference to the question of eminent domain rights in a report of the Board of Gas and Electric Light Commissioners of the State of Massachusetts, made to the Massachusetts Legislature, January 17, 1910, after an investigation into the methods used and the conditions governing the transmission of electricity in that commonwealth. The section of the report which deals with the question of eminent domain begins by stating that a bill was introduced into the State Senate, in the session of 1910, which sought the power of eminent domain for private rights of way for transmission lines. We quote:

"It was supported before the legislative committee by the interests owning the Connecticut River Transmission Company and the Amherst Power Company. The same interests, at the hearings under this resolve, urged the Board to recommend legislation of this character. The electric light and street railway companies also seemed to favor such legislation at the outset, but before the hearings closed the electric light companies withdrew their support and the Connecticut River Transmission Company appeared indifferent with regard to the matter. The Board was of the opinion, however, that the merits of this important question are not to be determined merely because certain special interests may be disposed to be satisfied with present conditions, and that the public, for whose use alone this right can be invoked, may take a different view.

"It is plain that the two principal high-tension transmission lines in this State, already mentioned, have been constructed without the exercise of eminent domain in obtaining their rights of way. It did not appear that any considerable deviation in route or excess cost had been occasioned because of lack of this power. It is fair to say that some of the most important hydro-electric developments in the country, with extensive transmission lines built over private rights of way, have been made in States in which the right to the exercise of eminent domain has not been given. Even where the right has been granted, for example, in the Niagara Falls development, both in New York and Ontario, the Board is informed that it has rarely been used in obtaining rights of way. It may therefore be urged that the grant of this right should wait until the necessity for its exercise is demonstrated by experience, and not given so long as the desired results can be otherwise attained.

"On the other hand, there is good reason to believe that what has already taken place in this State is but the forerunner of far more important developments. It is known that there are many water powers heretofore unused, because inaccessible, and their capacity and location will probably receive more public attention when the final report of the director of the United States Geological Survey is available. There are also water powers of greater capacity in neighboring States of New England not yet utilized, and it was stated at the hearings that within feasible transmission distance of Massachusetts cities and towns there is at least 300,000 undeveloped hydro-electric horsepower. To utilize this energy now going to waste, and to make it serve the convenience and necessities of the people and increase the productive capacity of the State, is, in the opinion of the Board, a problem of the greatest public importance, to the solution of which the Commonwealth may well lend the aid of its sovereign power, if this can be done with due regard to individual and community rights.

"Private property cannot be lawfully taken save for a public use, and a use is not necessarily public simply because the legislature declares it to be so. The Amherst Power and Connecticut River Transmission companies, whose lines have been described, were organized for the transmission of electricity for sale as power merely. This was apparently due to a desire to avoid being deemed and dealt with as public-service corporations, with the duty of serving all within reasonable reach of their lines at reasonable rates and without discrimination. If transmission lines are to be built for the sole purpose of delivering electrical energy for the production of mechanical power directly available only to the few who may be engaged in some manufacturing or mechanical pursuit, it is at least doubtful whether in law this is a public use. Even if sound in law, the Board believes that to base upon this the exercise of eminent domain would neither be expedient nor justifiable.

"On the other hand, if a transmission line is to be built to serve the public convenience by furnishing electricity to electric light companies or municipal plants for general distribution, or for distribution by the company owning and operating the transmission line, under the same obligations as now exist with respect to electric light companies, this is plainly a public use in aid of which the right of eminent domain may lawfully be granted, and the question then becomes solely one of expediency.

"Hostility to condemning land for any purpose is instinctive, but private rights must often yield where a definite public interest cannot otherwise be adequately served. The Board has already placed on record its belief in the importance to the State of encouraging the introduction of cheap power. The investigation under this resolve has strengthened its conviction that a substantial public convenience may be served by long-distance, high-tension transmission lines, and that more of them are likely to be built in the near future. It is also convinced that such transmission lines must be operated at such high voltages and supported by structures of such character as to make inexpedient their erection along public ways. In its study of the problem the Board has been impressed with the great practical difficulty of framing a bill which shall, at the same time, be constitutional and workable. Any authority to condemn private rights of way must be granted under adequate safeguards for the protection of the rights of the communities and individuals over whose territory such lines must pass, and the public character of the undertaking should be clearly established as a condition precedent to any exercise of the right. The time may not be distant when the proper development of electrical distribution will require the exercise of eminent domain, but after careful consideration the Board is not satisfied that the need is so urgent as to justify it in proposing a bill for that purpose at the present time. It therefore recommends that such legislation be postponed until experience more clearly demonstrates the need to exercise the right and discloses the character and extent of the public interest involved."—Editor.]

25—11. Would like to have copies of or information concerning laws governing the appointment of and duties of municipal inspectors in cities and towns where it is necessary to have an inspection previous to the installation being connected to central-station service.

Ross B. Mateer, Power Expert, Denver Gas and Electric Company, Denver, Colo.—All house wiring, business and industrial, must be inspected by the city inspectors, approved by them, and the central station company notified of such approval, before the central station runs a loop or sets a meter.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—Revised Laws, Chapter 122, Sec. 18, reads as follows:

"Section 18. A CITY SHALL, BY ORDINANCE, DESIGNATE OR PROVIDE FOR THE APPOINTMENT OF AN INSPECTOR OF WIRES, and any town may, at an annual town meeting, instruct its selectmen to appoint such an inspector. SUCH INSPECTOR SHALL SUPERVISE every wire over or under streets or buildings in such city or town and EVERY WIRE WITHIN A BUILDING which is designed to carry an electric light, heat or power current, shall notify the person or corporation owning or operating any such wire whenever its attachments, insulation, supports or appliances are improper or unsafe, or whenever the tags or marks thereof are insufficient or illegible shall, at the expense of the city or town, remove every wire the use of which has been abandoned, and every wire that is not tagged or marked, as hereinbefore required, and shall see that all laws and regulations relative to wires are strictly enforced. A city or town may recover in an action of contract of the person or corporation owning any wires so removed the expense which it has incurred for the removal thereof."

MISCELLANEOUS

0—82. We are threatened with severe gasoline lighting competition and are in immediate need of whatever publications are available and useful in fighting gasoline. Information, experience or data on the subject will be gratefully received.

(See February BULLETIN for other replies.)

R. J. Cantrell, Property Agent, Pacific Gas and Electric Company, San Francisco, Cal.—We are forwarding to you under separate cover a copy of Scott's Digest, copy of "Dangers of Gasoline," published by James A. Stewart, Madison, Wis., a copy of clipping from the Petaluma Argus, Petaluma, Cal., showing recent legislation against the use of gasoline, and are also handing you a pamphlet entitled "Gasoline," recently published by this company and made up of clippings from local papers within our own territory. We consider that these articles, showing accidents, fires, etc., occurring near home, would be of more interest and lead to better results toward the elimination of gasoline appliances than if quoted from outside, distant points.

In addition to the above, the larger cities in California—San Francisco, Oakland, Sacramento, San Jose—all have very stringent ordinances against the use of gasoline, most of such ordinances being based upon the Underwriters' requirements. The city of Chico in the northern section of our territory, last year, due to the fact of a very serious accident occurring from explosions and fire, killing two men in that city, passed an ordinance prohibiting the storage of gasoline in any quantity whatever; prohibiting the use of same by laundries or others for cleaning purposes, the only exception being that gasoline may be carried in automobiles.

While we have from time to time come in contact with gasoline appliances in some of the cities which we supply, we have never considered the matter of any particular importance, or as a menace to our business, for the reason that all such appliances from our experience, are short lived and owing to the difficulties and constant attention in keeping them in order, they are soon thrown out.

We also received some time ago copy of a pamphlet issued by the General Gaslight Company, Kalamazoo, Mich., entitled "Gasoline Lamps." We secured a number of these and distributed them where we thought they would do the most good.

John G. Learned, Chicago, Ill.—Mr. Victor L. Scott, San Antonio, Texas, has made a very exhaustive study of the subject and publishes a pamphlet showing sketches of what he has done, which, together with his other literature, when properly distributed, is very effective in competing with gasoline lighting installations.

Thos. W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—In Columbus we have replaced several gasoline installations by 150-watt clear tungsten lamps.

E. A. Aspnes, Manager, The Montevideo Electric Light and Power Company, Montevideo, Minn.—We have passed through an era of gasoline competition and consider ourselves victorious. The first battle was fought before the tungsten lamp made its appearance. Gasoline lamps and plants were installed daily and the agents boasted of the fact that they would soon have the electric light company out of business. We realized that knocking the gasoline lighting and printing hair-raising stories about gasoline explosions was of very little or no value. The next step was to determine under what conditions these plants were sold. It was found that the local agents had a profit of 50 per cent. In a round-about way the writer secured the agency for the same make and type of gasoline lighting systems and then advertised in the local papers as follows:

"The Montevideo Electric Light and Power Company have invested large sums of money for the purpose of furnishing the citizens of Montevideo with light and power. We therefore feel that we are entitled to the business. As some people seem to prefer gasoline lighting we have secured the agencies of the .... gasoline lamp and plants and are in position to sell and install such plants for one-half the price paid others for the same make of plants."

In the meantime we made arrangement with a saloon to discontinue the gasoline and use electric lights and also agreed to try to sell their gasoline plant, which was new. As soon as the advertisement appeared, inquiries began to come in for such lighting plants. One business man called on the writer with the view of investing and the following conversation followed:

A. "I want to buy a gasoline lighting plant."
B. "All right."
A. "Have you any in stock?"
B. "Yes. We have one down at Mr. ....'s saloon, new and in A-1 condition."
A. "Why, isn't Mr. .... using his new plant?"
B. "No. Not now. He has just changed over to electric lighting."
A. "......?......Well, I will see you later."

It is an absolute fact that we did not sell a single gasoline plant, nor did anyone else sell any for about two years from that date. The ad paid, although the sales were very slim.

Later on we introduced the maximum demand system of charging. After that came the tungsten lamp, the Holophane shades and the art of placing the lights in the most effective manner. To-day we consider gasoline competition nil.

0—32. In the case of companies whose employes have clubs or benefit associations, is it the custom to have associate members who are not employes of the company? What is the usual membership fee for such associate members? Is it considered a successful plan to have such members, or is the disadvantage of wiring contractors and others feeling that they must join more than the advantage from the income they give the club or association?

Thos. W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—We have in Columbus a club known as the Electric City Club. Only those engaged in the manufacturing, distributing or commercial fields of the electric companies are eligible to membership. We have no associate members, but invite electric contractors to be present at all meetings. So far this plan has worked out very well. Membership dues are 25 cents per month. At each meeting some member reads a paper on a subject previously assigned to him. This paper may be either original or something selected by him bearing on the subject.

Ross B. Mateer, The Denver Gas and Electric Company, Denver, Colo.—It is not the custom to have associate members or those who are not directly identified with the company. Monthly dues vary from 25 to 75 cents a member. Strife would be evident were one to insist upon wiring contractors becoming members of such an organization.

W. T. Fairbairn, Brooklyn, N. Y.—In Brooklyn only employes are eligible to membership in the benefit association. The dues are 50 cents per month; benefits, $7 per week in case of illness; doctor's visits free to member and at the reduced rate of $1.00 each to members of his family, and $100 to beneficiary in case of death.

The company has taken care of wiring contractors by organizing a separate association, known as the Kilowatt Club, to which employes, contractors, supply men, and manufacturers are eligible. There are, however, no sick or death benefits connected with this organization. The Edison Company also tenders the wiring contractors at least one banquet or outing each year.

1—9. How may the discoloration of brick walls (presumably due to mortar) be prevented or removed?

(Also answered in February BULLETIN.)

C. A. Lambert, Commonwealth Edison Company, Chicago, Ill.—I presume the inquiry refers to efflorescence appearing on brick walls. While there have been numerous formulæ published to overcome this defacement, none that I have been able to learn has proven successful, being to a certain extent only surface coatings which wear off in time, and rather expensive. I have frequently put this question to several brick experts and the only recommendation is that the deposit be washed off from time to time until the salts are entirly removed from the wall, which perhaps might be somewhat expensive, depending upon condition of wall. The cleansing may be done with water and brush, or a better scheme is to use a solution of muriatic acid, one part, to three parts water. After the acid has been on the surface a few minutes it should be removed by thoroughly scrubbing with several changes of clean water.

H. Frederico de la Frasse, Purchasing Agent, Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.—The discoloration of brick walls is due largely to the deliquescent condition of the lime used in the mortar. This becomes moist and attaches itself to the brick surface.

This is more apparent in cities bordering on the coast, due to fog and sudden changes of temperature.

Various formulas may be furnished for removing the discloration, such as painting with sour milk, or buttermilk, colored to give the same tint as the brick, or the questioner may try the formula given below as effective in some localities:

"Dissolve glue in hot water, in proportion of one ounce of glue to every gallon of water; add while hot a tablespoonful of alum, then one-half pound of Venetian red and one pound of Spanish brown. The proper tint may be obtained by adding, or omitting Spanish brown, as per the users' judgment."

NEW QUESTIONS

2—4. What has been your experience with the operation of automatic, or mechanically operated relief valves connected to the wheel cases in water-power plants, and are they absolutely necessary? Please state conditions under which they were used.

3—8. Will engineers of large central-station systems who are using the "dry tube" surface condensers, (mentioned in the Proceedings of the National Electric Light Association, of 1909, page 105) give information concerning same as to whether any drawbacks have been encountered since they were installed, whether they are actually giving the results that were mentioned in connection with the article quoted, and whether higher vacuum can be maintained by this condenser under similar conditions than with the standard condenser without the dry tube addition.

5—11. Will member companies please give us their experience in operating boilers under the following conditions: Our boilers are set to blow off at 125 pounds pressure, and this is the pressure carried through the peak of the load. After midnight when the load is light, and during the day, it is the custom of our firemen to allow the steam to fall to about 80 or 90 pounds. Is it or is it not more economical for us to hold the pressure at 125 pounds all the time?

6—5. How should a steam-engine piston body be fitted to the rod? Should rod and hole in piston body be slightly tapered and piston forced on rod, and up against a flange on rod; or will a cylindrical rod and cylindrical hole in piston body, fitted loose enough so that before nut is tightened, the piston can be rotated on the rod, and when nut is tightened, this only to keep piston body from rotating, be equally satisfactory?

12—43. What do member companies consider the maximum length of common secondary desirable? Is each case figured on a certain allowable voltage drop basis or is there an arbitrary limit as to length? What size wire is used for same and how is size determined? Are transformers operated in parallel, feeding different points on the same secondary?

12—44. Is it considered good practise to install a 50-kilowatt transformer on a single pole? Is it advisable to reinforce the base of a pole carrying heavy transformers with concrete?

12—45. This company has been supplying 220-volt service from our lighting network to operate a 2½-kilowatt wireless telegraph outfit. Our system is overhead, 2200-volt primary, 110-220-volt secondary, transformers banked, neutral grounded. When the outfit was operated, considerable trouble was

experienced on the consumer's premises in the immediate neighborhood, due to the breaking down of lamps, sockets, and insulating joints, and to meter stoppages.

Was this trouble caused by our overhead wires acting as receiver circuits, or was it due to a "kick-back" through the step-up transformer of the outfit, or to some other cause?

What can be done to remedy the trouble?

We would appreciate any information from companies supplying service to this class of business, regarding kind of service supplied, method of supplying same, trouble experienced, and methods of remedying same.

13—15. Have any member companies had any experience with a device known as the Wireless Cable Tester and Trouble Finder, and if so what are the results?

13—16. What capacity of subway transformers has it been found feasible to install in a single manhole?

13—17. Has it been found advisable for large subway transformer installations to provide artificial ventilation for the manhole? If so how has this been accomplished?

13—18. Has it been found advisable to keep transformer vaults separate from the regular manhole?

13—19. What are the relative advantages and disadvantages of one piece built-in conduit and the regular clay duct? What is the comparative cost of material and labor excluding the cost of digging and filling?

13—20. In operating with reserve 13,000-volt cables, which is the better policy, to keep reserve cables alive on 13,000-volt bus (thus subjecting them to possible damage as result of surges on system) or to keep them dead, and take chance on their failing when most needed?

13—21. Is there any chance of damaging good cable by repeated tests at 13,000 volts, no load?

13—22. Is it good operation to put interrupted current on faulty cable, after insulation has been broken, for purpose of hunting trouble with telephone receiver and detector coil? If not, why?

13—23. What would be the best method combining quality and cheapness of connecting temporary street illuminations from an underground system in which no poles at all are used, consumers' taps being taken from service boxes under the sidewalk? Cables, lead covered, run in tile conduits. There are iron poles for trolley wire construction.

14—7. Have any member companies had any experience with the Edison Battery for vehicle work? Would certainly appreciate any information we can get on this subject.

16—41.—What experience, if any, have member companies had in the use and installing of the 400 and 500-watt Mazda units, as to life and methods of installing?

17—30. This company has been trying to get a company prominent in the development of lighting fixtures to furnish fixture for inverted lighting with a reflector and outer casing of glass, the outer casing being dense enough and so tinted as to bring the light value to about that of the ceiling above thereby avoiding the dark underbody of the fixtures now generally used for this work, with the sharp contrasts involved.

A fixture of the above description would be especially suited to rooms where fixture itself is often in the line of vision, such as bed-rooms, hospital wards, etc.

Would there not be a considerable demand for such a fixture?

17—31. Will some member please advise a practical electrician, with a fair electrical engineering education and six years' experience, as to the best procedure of study to qualify as an illuminating engineer? Give also the essential requirements as to what an illuminating engineer should know.

17—22. On page 87 of the "Solicitors' Handbook" a table of Reflection Coefficients is given. Where would Holophane reflectors stand on this table, if inserted?

17—23. When member companies replace or have replaced outside Nernst lamps in front of customers' premises, with tungsten lamps, what sort of fixture unit is used?

19—49. Would appreciate any information obtainable on the electric drive for rock-crushing plants, particularly as to the current consumption per cubic yard, and the average load factor for this class of work?

19—50. Have member companies been successful in securing power contracts for the complete operation of (a) breweries, (b) laundries?
If so, under what conditions were the contracts secured?

20—75. What experience have member companies had with Wright maximum demand meters on three-phase motor installations?

20—76. What has been the experience of member companies with the new 25 cent prepayment meter? What is the average monthly revenue per meter? What do you figure must be secured as the minimum revenue per meter before the installation of this meter pays?

23—30. In figuring out the kilowatt-hour output from large central stations for the purpose of obtaining the coal per kilowatt-hour and the cost per kilowatt-hour of the generating station, is it customary to include the total kilowatt-hours generated by the machines, or is the energy consumed by the motor driven exciters, station lighting and miscellaneous power supply in the station itself, subtracted from the total actual output of the alternators?

23—31. Do our large central station companies in working out the B. T. U. per pound of coal make use of the actual calorimeter measurements or calculate the heat units by means of formula from the analysis? If the latter case, give formula which you have found particularly applicable to semi-bituminous coals of the eastern district.

23—32. We are endeavoring to ascertain the best method for dealing with accounts for wiring and material sold, and if it is advisable to record them separately from light and power charges, so that confusion in the consumer's ledger would be obliterated. Will member companies please give their system of dealing with this question and state if wiring and material items are included as arrears on light and power bills, and also in case of agreement to pay material accounts by installments, how should this be handled?

24—52. If a customer's meter tests 10 per cent fast, at 1-10 load, and O.K. at 3-4 load, upon what basis should a rebate be made to the customer? Have any of the State Commissions ruled upon this question?

24—53. Assuming that a company expended $100,000 per annum in its sales department for the promotion of its business, what is the minimum amount of annual revenue secured that would justify the expenditure?

23—54. What companies maintain a reference library in their main office building? What is the nature and extent of such libraries, i. e., approximate number of volumes and character of books and publications? Is library open to all employes, or to officers and heads of departments only?

28—1. Have any member companies had any experience in installing a street lighting system, composed of combination lighting and tramway poles, using multiple tungsten lamps? We particularly desire to know whether an increase in cost of maintenance is found, resulting from vibration of poles, etc.

29—1. In heavy electric trucks, which seems best practise, one or two motors? What are the advantages and disadvantages of two motors over one with differential?

Repeated Questions

The following recent questions have received no reply or else it is felt that further replies are called for and would be of value. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

0—24. What attempt is being made to standardize the charging plugs for electric vehicles? We have recently had to provide five different plugs.

***5—8. Has there ever been a satisfactory solution for scale in boilers in a plant running noncondensing and using very hard water? If so, what is it?**

5—10. What does it cost member companies to clean Babcock and Wilcox Boilers?

***11—20. What is the practise of transmission companies having oil switches on high-voltage circuits (15 and 30 K. V.) in inspecting and changing the oil? Is the sediment which forms in the oil detrimental to their operation?**

13—14. With what success has lead-covered, steel-armored cable been used in underground construction for series street lighting systems, especially on alternating current systems?

15—53. What has been the experience of member companies with standard types of current transformers?

If accidents have occurred, what has been the size of the transformer and the potential and amount of energy behind it?

16—37. I would like information regarding all cities where ornamental posts, using other than tungsten lamps, have been installed for ornamental street lighting or for improvement of business streets.

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40- and 80-watt tungsten series lamp.

16—40. We have, during the last two months, been trying out the "Pemco" tungsten arc lamp equipped with 250-watt, 6.6 ampere series Mazda lamps and roughed inside globes, in comparison with 6.6 ampere series inclosed arc lamp with opal inner globes, for street lighting in our city. We would like to hear the opinions of other central stations, if there are any that have tried these lamps, as to the comparative efficiency of the two lamps for street lighting service.

20—76. Will some member company give information in regard to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

***21—26. We are fighting hard to secure the business of our city to operate their water-works by electric current. Will member companies who supply current to water-works help us with data and information which might aid us in getting this business?**

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

22—46. What is approximately the average charge per pair of flaming arcs (commercial lighting) in cities which make special rates for this class of lighting? I believe that we have been selling this light at a price lower than we

can take care of these lamps, and I would be very glad to know what others are receiving for such service.

*22—47.—Wanted: Information from member companies, regarding the amount spent by the cities in which they are located per square mile for street lighting service. In other words, I wish the result obtained by dividing the number of square miles in the city by the yearly appropriation for street lights.

23—25. What is the average revenue obtained by member companies on electric irons, toasters and sewing-machine motors?

24—43. Where company regularly inspect signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat rate outline and sign work, where competitive electric lighting companies are in the same field?

*24—46. Since the recent hearing before the Interstate Commerce Commission, the papers and magazines have been full of the doctrine of efficiency or scientific management, implying, in general, that in many cases by scientific planning, employes as individuals and the organization as a whole, can accomplish more work with less expenditure of time and effort, thereby enabling individual wages to be increased, and yet a saving effected to the corporation.

Assuming for the sake of argument that scientific management, so-called, can accomplish a large part of what is claimed for it in industrial establishments, and even in railroads, is there any opportunity to effect a similar saving in electric light and power companies?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

25—10. What states have statutes giving the right of eminent domain to power generating and transmission companies for pole lines? Is there available a pamphlet or book containing copies of all existing statutes covering this point?

25—11. Would like to have copies of or information concerning laws governing the appointment of and duties of municipal inspectors in cities and towns where it is necessary to have an inspection previous to the installation being connected to central-station service.

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THIRTY-FOURTH CONVENTION—NEW YORK
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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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CONTENTS

GOING TO CONVENTION

One of the distinctive features of American development and social life during the past twenty-five years has been the creation of bodies representative of some industry or principle and their gathering in convention once a year or oftener for the discussion of interesting subjects and the determination of various questions by general vote. The National Electric Light Association has been conspicuous in the evolution of this idea in the industrial field, and its conventions, of which it is about to hold the thirty-fourth, have steadily grown in magnitude and importance. Among societies that speak and act for a special art it has won a distinctive place by reason of the excellence of its conventions, quite aside from its other work. The growth of its membership, now over 7500, brings with it an attendance in convention of at least 3500; and the question naturally arises as to what size this annual parliament can safely attain. But whatever may be the result of present tendencies, it is certain that the annual meeting of the

Association will remain its most vital and characteristic function.

In view of the large attendance, already embarrassing to handle anywhere save in two or three cities, it may seem rather unnecessary to urge members to be present. The fact is, however, that mere numbers are not the essential. It is the nature of the attendance that has to be considered. This Association is based fundamentally on central-station companies, with which rests the power for decision and action in any matter affecting the welfare of the industry; and when it is desired to give force and weight to any determination reached, it is extremely desirable also that the vote on such resolutions should be as large and representative as possible, after full debate. This applies to practically all the issues of the day, technical or otherwise, and the only way for member companies to put their views into concrete and effective expression is to attend the convention.

We could say much on the social side of the argument in favor of attending, for it is obvious that an industry cannot be best promoted and protected where the men engaged in it do not know each other. We have never known a central-station manager who having once attended a meeting of our Association did not come again as often as he could; and we now want to urge upon the officers of some three or four hundred companies whose names have never yet appeared in the registration to seize the opportunity next month of "standing up to be counted" among us. It will never be regretted; a larger and stimulating view will be obtained over the whole conduct of a difficult business; there will be amusement as well as instruction—and the warmest welcome awaits!

CENTRAL STATION WELFARE WORK

The Public Policy Committee of the National Electric Light Association, which during the past winter has been devoting considerable attention to the various aspects of welfare work as related to the central station industry, held a final meeting at the New York headquarters in the United Engineering Building on March 28, when the report which has been prepared through a series of long conferences was unanimously adopted, and the recommendations and suggestions were then put in definite shape for presentation to the member companies, in number nearly a thousand, at the annual convention in New York next May. The committee has felt the importance of the questions pertaining to the welfare of employes in the central station industry, now growing so rapidly, which has recruited proportionately its forces that it desires to associate with itself more closely and permanently in reciprocal interest. The committee has felt it important that all notions of philanthropy or charity be entirely eliminated in the suggestion of such relations, and following recent American and European precedent in some respects has studied to work out various plans which may be adopted separately or comprehensively by any company in membership. Several of the companies already have in force some of the schemes proposed, but it is not assumed that every company will wish to adopt every form of relationship

outlined in the report. Wide differences may exist in different communities and companies, not only regarding financial resources, but in the personality of the employes and in public sentiment. The plan includes accident insurance, sickness insurance and death benefit, service annuities, profit sharing, employes' savings and investment funds, and life insurance, although with regard to the last item it is suggested that the companies limit themselves to providing their employes with all possible information in connection with safe-low-cost life insurance, and do not put in force any plan of their own.

The coming report will give in detail the methods by which provision can be made under each of the other heads. By unanimous vote the term "pension" has been dropped, and the service annuity adopted as the recognition of an automatic recompense for continuous service, and the committee is of the opinion that member companies should provide such annuities for every male employe reaching the age of sixty-five and every female employe of sixty years after continuous and satisfactory record of ten years of service. The details of profit-sharing are also very interesting, based upon the idea that it is better to have those engaged in the industry as partners rather than employes, and that preferably profits of the employe based upon his wage scale should reach him in the securities of his company and that dividends upon such securities should be paid in cash, in the manner customary with other security holders. Details are also given with regard to savings funds and investment funds, with the object of promoting thrift amongst employes and, where feasible, combining the plan of profit-sharing, it having been found that the two work out very satisfactorily together. The report goes into considerable detail and no summary could well do justice to the care and pains with which each point has been considered.

It is believed that it is the first time in the history of the country that an Association representing so many corporations—now nearly 1000—and representing over ninety per cent of the investment and earnings in the industry for which it stands, has taken up such a subject in this comprehensive and thoroughgoing manner, and the report itself will be awaited with the utmost interest by all connected with public utilities and by economists in general.

Work of the Transportation Committee

Before the present month is out, Mr. Charles H. Hodskinson, Master of Transportation, 70 State Street, Boston, Mass., will issue his circular as to travel rates, trains and plans for the coming New York Convention. Meantime an immense amount of work is being done in the way of negotiation with traffic associations and arranging for special trains and other features of the work. At the time of the Convention, Mr. Hodskinson will conduct in the foyer of the United Engineering Building a full-fledged transportation office giving members every facility and convenience; and as an attendance of 3,500 seems assured already, it will be seen that the work of such a bureau will be anything but light. The committee formed by Mr. Hodskinson for the work in advance has been admirably selected and is as follows:

R. H. Ballard, Southern Edison Co., Los Angeles, Cal.; W. J. Barker, Denver Gas & Electric Co., Denver,

Colo.; E. J. Bowers, Kansas City Electric Light Co., Kansas City, Mo; J. A. Britton, Pacific Gas & Electric Co., San Francisco, Cal.; F. A. Coupal, Buffalo General Electric Co., Buffalo, N. Y.; J. E. Davidson, Pacific Power & Light Co., Portland, Oregon; P. Doty, St. Paul Gas Light Co., St. Paul, Minn.; J. B. Eaton, Rochester Railway & Light Co., Rochester, N. Y.; W. L. Emery, Utah Light & Railway Co., Salt Lake City, Utah; G. A. Freeman, Commonwealth Edison Co., Chicago, Ill.; F. H. Gale, General Electric Co., Schenectady, N. Y.; A. F. Giles, General Electric Co., Atlanta, Ga.; W. J. Grambs, Seattle Electric Co., Seattle, Wash.; M. S. Hart, Consumers Electric Light & Power Co., New Orleans, La.; H. A. Holdrege, Omaha Electric Light & Power Co., Omaha, Neb.; H. M. Hope, Stone & Webster Corp., Boston, Mass.; F. N. Jewett, Wagner Electric Manufacturing Co., St. Louis, Mo.; T. F. Kelly, Hamilton Electric Light & Power Co., Hamilton, Can.; A. H. Manwaring, Philadelphia Electric Co., Philadelphia, Pa.; J. C. McQuiston, Westinghouse Department of Publicity, East Pittsburgh, Pa.; H. Nash, Jr., Dallas Electric Light & Power Co., Dallas, Texas; A. A. Serva, Fort Wayne Electric Works, Fort Wayne, Ind.

The Convention Daily

The Association has accepted the generous offer of the *Electrical World* to publish for it, as its contribution to the Convention of 1911, a convention "daily" along the lines of that issued at St. Louis last year, and improved in various respects. This will be a large quarto paper ranging from about 24 to 36 pages, and there will be no fewer than five daily issues obtainable by all in attendance and delivered at all the leading hotels where delegates are registered. The issues will continue from Tuesday until Saturday inclusive—May 30 to June 3, and will thus furnish a complete record of the Convention. It is found that there is a demand each year for copies to send away during the convention week, and the Association to provide in advance for the numerous inquiries and requests that come to it, has made arrangements so that sets will be mailed to any address for 25 cents to cover the postage and incidental work. Requests for such mailing should be filed at once at headquarters with the Secretary accompanied by the small fee.

Activity of the Hotel Committee

The Hotel Committee of the Association, Mr. Frank W. Smith, chairman, is taking active initiative as to convention work by issuing this week a circular with regard to hotel provision for the convention May 29—June 2, when the meetings will be held at the United Engineering Building, New York. The quarto size circular of the Committee is quite an elaborate piece of work in colors, and includes a list of fifty-four hotels with their location, telephone numbers and the fullest details as to accommodations and prices. In addition to this, the circular, which bears on the outside an admirable vignette of the Engineering Building, embodies also a colored outline map of Manhattan Island showing the location of the Building and of every one of the hotels listed, so that the public can see at a glance the relative distance, convenience, etc., of all the accommodations. The map includes also lines of elevated railroad and subway with the stations indicated. As an attendance of at least 3500 is now expected and virtually assured, Mr. Smith is anxious that all who

intend to be present will avail themselves of the data thus furnished and will return to him the reply postal card which will enable the appropriate reservations to be made.

Conference on Water Powers and Governmental Control

On Saturday, April 8, under the auspices of the Power Transmission Section of the Association, New York City, a conference of members of engineering societies and the general public was held to consider the subject of the governmental control of water-powers and the present "deadlock" in regard to the utilization of all such powers located on national land. There were two sessions, both of which were very well attended by large and representative audiences, and the interest manifested in the discussions was most pronounced and at times intense. Special importance was given to the occasion by the presence of the Hon. W. L. Fisher, the new Secretary of the Interior, who thus made his first public appearance in that capacity. He spoke twice and each time expressed his appreciation of the value of the conference as a means of developing information, and as a point of new departure; for, as he said, at this moment there is no governmental policy concerning the use of these water-powers. He had a warm and sympathetic reception.

The meeting was presided over by Mr. H. L. Doherty, the chairman of the Section, who made an admirable introductory address. He was followed by Mr. S. Z. Mitchell, with an exhaustive and elaborate paper of great value on the question from the investor's standpoint. These two documents were available in printed form and were in great demand. Others who spoke or read addresses were Messrs. J. R. McKee, R. Lamb, J. G. White, H. E. Cutler, F. E. Frothingham, John Bogart, J. H. Finney, C. F. Scott, R. D. Mershon, Frank J. Sprague, Percy H. Thomas and R. D. Rushmore.

A committee consisting of Messrs. S. Z. Mitchell, R. D. Mershon, C. F. Scott, P. G. Gossler, M. A. Viele and C. F. Wallace was appointed to formulate resolutions expressing the general opinion of the conference. This committee reported as follows, the resolutions being unanimously adopted:

"*Resolved,* That it is the sense of this meeting, convened at the instance of the power transmission section of the national body, that the National Electric Light Association should offer its co-operation with the legislature and executive branches of the national and state governments for the formulation of a definite, constructive policy which will encourage the prompt and fullest development of our water-powers in the public interests; and be it further

"*Resolved,* That to this end it is recommended that the officers of the National Electric Light Association appoint a committee or committees with power to act in the premises, and to invite the co-operation of such engineering, commercial or other bodies as they may deem expedient."

A rising vote of thanks was given to Secretary Fisher and Director George Otis Smith, of the United States Geological Survey, for their presence.

It is proposed by the Section and Association to issue shortly the report of the conference in pamphlet form.

A FREE COPY OF THE QUESTION BOX REVISION

As was announced last month, the material in the issues of the *Question Box* for the first four or five years has been revised and digested, and is now being put together in book form. The text is in the hands of the

printer. A copy of the book will go to each Class A (company) member, but in addition it is proposed to furnish a copy free to each Class B member enrolled up to the end of 1910 who may apply for it by May 15. This is the last notice that will be given, as it is necessary to know the number that will thus be required. A limited edition will be on sale at $1.00 per copy.

THE NEW COMMERCIAL SECTION

What promises to be one of the most beneficial undertakings ever launched under the auspices of the National Electric Light Association is the new Commercial Section. There are by this time probably very few Class B or Class E members of the Association—all of whom are eligible for membership in the new Section—who have not heard something of its scope, owing to the systematic manner in which the Membership Committee has been spreading its propaganda. However, there are something like 5300 eligible persons who have not yet become members, and for the special behoof of these persons the BULLETIN wishes to call attention to the advantages of belonging to the Commercial Section. With this issue goes an application blank for the Section membership.

It goes without saying that anything that will increase one's efficiency in his chosen vocation is worth a little investment; and the investment of $2.50 for membership in the Commercial Section can hardly fail to bring manifold returns to any ambitious central station commercial man, whether he be a specialist on power, distribution, street lighting, sign lighting, refrigeration, or any of the multiform subjects which the Section committees will investigate.

A mere list of the principal committees of the Commercial Section and of their chairmen, together with the statement that these committees will compile and issue publications giving much-needed data on their respective subjects, should be sufficient to emphasize the benefits of Section membership. The Committees and their chairmen are as follows:

Committee on Heating, Refrigeration and Kindred Appliance Sales: Mr. F. H. Gale, Chairman, General Electric Co., Schenectady, N. Y.; Committee on Functions of a Sales Department: Mr. T. I. Jones, Edison Electric Illuminating Co., Brooklyn, N. Y.; Committee on Electric Vehicles: Mr. J. T. Hutchings, Chairman, General Manager, Rochester Railway & Light Co.; Committee on Improved Wiring and Wiring Equipment Standards: Mr. M. C. Rypinski, Chairman, Westinghouse Electric and Manufacturing Co., 165 Broadway, New York; Committee on Residence Business: Clare N. Stannard, Chairman, Denver Gas & Electric Co., Denver, Colo.; Committee on Advertising: C. W. Lee, Chairman, C. W. Lee Co., 90 West St., New York City; Committee on Sign Lighting: Mr. E. L. Callahan, Chairman, H. M. Byllesby & Co., Chicago, Ill.; Committee on Electricity in Rural Districts: Mr. John G. Learned, Chairman, North Shore Electric Co., Chicago, Ill.; Committee on Industrial Light: Mr. M. M. Sloan, Birmingham Railway Light & Power Co., Birmingham, Ala.; Committee on Membership: Mr. J. Robert Crouse, Chairman, National Electric Lamp Association, 1823 E. 45th St., Cleveland, Ohio; Committee on Power: Mr. E. W. Lloyd, Chairman, Commonwealth Edison Co., Chicago, Ill.; Committee on Street

Lighting: Mr. William Rawson Collier, Chairman, Georgia Railway & Electric Co., Atlanta, Ga.; Committee on Competitive Illuminants: Mr. H. J. Gille, Chairman, Minneapolis General Electric Co., Minneapolis, Minn.

One valuable feature of the Commercial Section is that membership therein is open to manufacturers' representatives as well as to central station men. It is believed that close co-operation between the manufacturers and operating companies cannot fail to bring about the best of understanding between them in their commercial relations, as well as to cement them in a union of good-will which will insure harmonious progress. It is hoped to make the Commercial Section a model of co-operative efficiency, and to this end members are desired whose ambitions, aspirations and inclinations will lead them to join in a movement which cannot fail to increase their individual efficiency and prestige.

Some of those who are eligible for membership have been heard to ask, "Why should I be expected to pay $7.50 per annum for the privileges and advantages of the National Electric Light Association when others pay but $5.00?" If the reader is one of those who are of this attitude, we certainly ought to explain to him that the extra $2.50 goes to procure the *extra* benefits of the Commercial Section, which are rendered *only* to its members. The question is not one of paying an increased price for existing privileges, but rather of an opportunity to invest in a means of broadening one's viewpoint and increasing one's grasp on the important details of his profession.

A banquet will be given on Monday evening, June 1, at the Hotel Martinique, New York City, to all who have had part in the securing of new members for the Commercial Section. The main feature of the banquet will be the presentation of the sterling silver loving cup donated by Mr. J. Robert Crouse to the person who succeeds in securing the largest number of new members.

Application blanks and any desired information regarding the Commercial Section may be obtained from the Secretary of the National Electric Light Association, 29 W. 39th St., New York City, or from Mr. J. Robert Crouse, Chairman of the Membership Committee, 1823 E. 45th St., Cleveland, Ohio.

GEORGE WILLIAMS,
Chairman of Section.

CHANGES IN THE NATIONAL ELECTRICAL CODE

The Electrical Committee of the Underwriters' National Electric Association has passed out of existence, and in its place an Electrical Committee of the National Fire Protection Association has been formed, which will have oversight of the National Electrical Code in the same way that the Electrical Committee of the Underwriters has previously had. This new electrical committee, besides including representatives of the Underwriters, has added representatives from the following organizations: American Institute of Electrical Engineers, National Electric Light Association, National Contractors' Association, National Electrical Inspectors' Association and American Electric Railway Association. It is proposed to hold a public meeting biennially. The Electrical Committee, however, will, in all probability, have more frequent meetings to take up important matters which may be brought to its attention in the interims.

The first public meeting of this committee was held on March 22 and 23, in the rooms of the New York Board of Fire Underwriters,

123 William Street, New York City, and various changes in the National Electrical Code were adopted. It is hardly necessary to detail all of these changes for full accounts of them are found in all the electrical magazines. There are, however, a few changes of importance to which the attention of the members of this Association should be particularly called.

The change of greatest importance is that of the substitution of new and severe specifications for the old and imperfect specifications for rubber covered wire. The new specifications, besides calling for the usual insulation tests, contain requirements as to elasticity and other mechanical qualities. There is also a severe chemical test and an ash test imposed. While it is recognized that the present specifications are defective, it is not clear that the new specifications will be the means of producing a wire which has any better lasting qualities than the present wire. The effect of the new specifications on the cost of the wire is a serious matter. The first statement from the manufacturers was to the effect that the new specifications would call for an increase in price of not less than forty per cent and in some cases, perhaps, as high as two hundred per cent. During the meeting certain manufacturers stated that in their opinion the increase would not be over fifteen or twenty per cent. An increase of fifteen per cent is not a serious matter, but if the cost of the wire jumps two hundred or even forty per cent, it will be a serious handicap to the electric lighting companies, in that it will make electric lighting less popular. In adopting the new specifications, provision was made for the carrying out of all existing wiring contracts, and it was mutually agreed that the new specifications would not be put in force until some future date, which is to be agreed upon by the wire manufacturers, the contractors and the underwriters.

An attempt was made to put into the Code, rules for low voltage transformers, but this failed to carry. The only point of importance in this connection was the adoption of a rule permitting the installation of fifty receptacles for sign, outline and decorative lighting on two-wire circuits of less than fifty volts.

The changes in the rules in regard to cabinets were approved and a more substantial type of box is now called for. The last edition of the Code required that split knobs and cleats be fastened by means of screws. This rule is now changed to allow the use of nails as well as screws.

For many years, Rule 13A has specified that overhead circuits which are grounded must have the ground connection every two hundred and fifty feet, while for underground systems a space of five hundred feet is allowed. This has now been made uniform and when the system is grounded the ground wire must be run "at least every five hundred feet," whether overhead or underground.

The Underwriters were not willing to pass a rule which should make mandatory the grounding of secondary alternating-current circuits, but a set of resolutions were adopted which recognized that by grounding these circuits of not over one hundred and fifty volts, the life hazard is effectually eliminated. These resolutions recommend that municipal departments be urged to make the grounding mandatory and that Underwriters' inspection departments use their influence to get the ground wires put on because it is a desirable precaution which introduces no fire hazard.

A further resolution was "that the National Electric Light Association be urged to see that all of its member companies be brought to realize the necessity of such grounding for the protection of their customers." Water works departments were also urged to allow the use of their pipes for ground connections, with the assurance that the integrity of the system would in no way be affected. The American Institute of Electrical Engineers was urged to use its best endeavors to secure unanimity of opinion as to the desirable limit of the voltage which is to be grounded. Hereafter, the Code will be published under one cover instead of in two pamphlets as the last edition was printed.

Annual Meeting of the New England Section

The annual meeting of the New England Section was held in Boston, on March 17, at the Edison Building As previously decided by vote of the members, in view of the approach of the New York convention of the National body, the usual programme features of papers and discussions were dispensed with, and a business meeting was held for the election of officers and the presentation of reports. The new officers elected are the following: President, Howard T. Sands, Malden, Mass.; vice-president, Arthur B. Lisle, Providence, R. I.; treasurer, Welles H. Holmes, Cambridge, Mass.; secretary, Miss O. A. Barsiel, Boston. The executive committee is as follows: J. A. Fleet, Portland, Me.; J. S. Whitaker, Portsmouth, N. H.; A. F. Townsend, Woonsocket, R. I.; R. W. Rollins, Hartford, Conn.; Geo. S. Haley, Rutland, Vt.; L. D. Gibbs, Boston: Alex. J. Campbell, ex-officio, New London, Conn.

After the election, the reports of different officers and committees were read and approved. The hope and belief were expressed that a very generous representation of the New England Section at the coming National convention would be seen.

Entertainment at the New York Convention

At a meeting of the Entertainment Committee, under the chairmanship of Mr. Arthur Williams, held on April 18, considerable progress was made with regard to the entertainment of the delegates and visitors at the convention, May 29—June 2. Several arrangements have still to be completed which will be announced later but the main lines have been laid down. The meeting will be notably of a work-a-day character with four full days of sessions, averaging eight hours daily, but there will be intermissions and interludes.

The opening reception on Monday evening, May 29, will be of an original character in the nature of a promenade concert at the Hotel Astor, with a concert in the Roof Garden and Belvedere and dancing in the main ball room. Provisions are being made for about 2000 persons.

On another evening in the week there will be a meeting of the Public Policy Committee it is proposed, when the new programme of the Association as to welfare work will be presented, and discussed by persons of prominence.

Another evening will be devoted to a theatre party, for which three of the largest theatres have already been engaged, making provision for not less than 3000 people.

During the week there will also be a ball game between a team of the Brooklyn Edison or New York Edison Company and a team of the Philadelphia Electric Company.

There will also be an afternoon tea for ladies at the Plaza Hotel and probably a morning concert, as well as provision for automobile rides to points of interest in the vicinity. For those who play golf, provision has been made at six of the Metropolitan links to which free access and free transportation will be furnished. In connection with the baseball contest it is proposed that an Association cup shall be presented to the winning team.

The convention will close on Friday afternoon to be followed by a meeting and dinner of the Sons of Jove at Coney Island.

On Saturday, which is a non-official day, the local operating companies will make guests of all the delegates who remain and will take them on a steamboat on a tour of inspection of the largest generating plants on Manhattan Island, including also the huge one of the Consolidated Gas Company at Astoria. During the afternoon, after the inspection, a trip will be made up the Hudson and in the evening a landing will be made at Dreamland, Coney Island, at an hour which will permit the visitors to see the brilliant and spectacular illumination of that famous sea side resort. After that the delegates will be allowed to go home.

Registration for the May Meeting

Next week there will be sent out from the Association offices the regular circular, with cards as to registration for the coming convention, and it is most earnestly requested that members will use the cards if they propose to attend, and will forward them at once to the Secretary. In this way work at headquarters is lightened during "the peak," congestion is prevented at the various bureaus when the meeting begins, and the comfort of everybody is insured and enhanced. The Hotel Committee has already sent out its circular and card as to reservations, and that matter should also receive prompt attention. Toward the end of the month, the Master of Transportation will also issue his circular with regard to trains and rates, and the May BULLETIN will give the final intelligence as to these and other matters of interest to the members in regard to the convention.

Over Eleven Hundred Members More

This month we print by far the largest list of new members that the Association has ever known in a like period—and we have had some pretty large enrollments before. In the accompanying list there are no fewer than 1163 names, bringing the membership up to a total of 7521 on April 18. During the month up to that date about 260 names were taken off the list for one reason or another, so that the gross has reached nearly 7800. It is hoped to make that the net figure before the month is out, *viz.*, by May 1. In the present list there are 13 Class A, 2 Class C, 5 Class D, 22 Class 2, and 1121 Class B. The great gain in the last class is due to the activity in the New York Section, which has reached the 1000 mark, and is now the leader. Chicago has long led the list, and if it included the North Shore Section might still be at the top of the column. The New York Section embraces eleven local companies.

It may be added that during the past month individual Class B and E members have enrolled in the Commercial Section to the number of 156 and in the Power Transmission Section 12. Both of these National Sections are growing nicely, and reference will be found in this issue to the good work that both are doing.

NEW MEMBERS

Class A: Cloverdale Light & Power Company, San Francisco, Cal.; Georgia Power Company, Atlanta, Ga.; Columbus Power Company, Columbus, Ga.; Consolidated Ice & Power Company, Valdosta, Ga.; Portland Power & Development Company, Damariscotta, Me.; Manchester Electric Company, Manchester, Mass.; Vineyard Lighting Company, Newton, Mass.; O'Neil Light & Power Company, O'Neil, Nebr.; Halfmoon Light, Heat & Power Company, Mechanicsville, N. Y.; Dutchess Light, Heat & Power Company, Rhinebeck, N. Y.; Oswegatchie Hydraulic Power Company, South Edwards, N. Y.; West Branch Light & Power Company, Stamford, N. Y.; Klamath Falls Light & Water Company, Klamath Falls, Ore.

Class C: Madison Gas and Electric Company, Madison, Wis.—W. R. Schmidley, J. N. Cadby.

Class D: Crocker Wheeler Company, Boston, Mass.—Clarence E. Delafield.

Electrocraft Publishing Company, Detroit, Mich.

Albany Southern Railroad Company, Albany, N. Y.—Frank L. Smith.

Vacuna Sales Company, New York City.

Macbeth-Evans Glass Company, Pittsburgh, Pa.

Class E: Bryant Electric Company, Bridgeport, Conn.—Frank V. Burton.

Pettingell Andrews Company, S. Boston, Mass.—F. G. Hartwell, James I. Finnie.

Electric Testing Laboratories, New York City.

General Electric Company, New York City.—Ernest L. Brown, W. F. Cale, Ward E. Krone, Paul E. Matteson.

Sprague Electric Company, New York City.—E. R. Van Buskirk.

Vacuna Sales Company, New York City.—Richard E. Brown.

Holophane Company, Cleveland, Ohio.—John C. Presbury, Arthur J. Sweet, H. J. Tait.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.—D. S. Brown, J. E. Brown, H. W. Cope, William H. Easton, A. V. S. Lindsley, Robert Mather, M. C. Turpin, C. S. Vail, K. E. Van Kuran.

Class B: Birmingham Railway Light and Power Company, Birmingham, Ala.—M. S. Sloan.

Southern California Edison Company, Los Angeles, Cal.—Frank H. Balfour, T. A. Green, Walter M. McKnight, Edward H. Mulligan, W. R. Neelands, C. S. Walton.

Pacific Gas and Electric Company, Redwood, Cal.—M. E. Ryan.

San Diego Consolidated Gas and Electric Company, San Diego, Cal.—A. E. Holloway.

Santa Barbara Gas and Electric Company, Santa Barbara, Cal.—G. W. Wilder.

Colorado Springs Electric Light, Heat and Power Company, Colorado Springs, Colo.—C. A. Sunderlin.

Denver Gas and Electric Company, Denver, Colo.—M. W. Bailey, V. L. Board, Urban Bourke, George J. Bucher, Bruce Edmund Clark, H. A. Connelly, Norman B. Coster, R. W. Curran, E. F. Curtiss, Bernard Daffer, Roy A. Eck, R. F. Egerer, Thomas E. Floyd, J. W. Francis, Nelson H. Freeman, G. D. Gerhart, William S. Goodale, S. Green, E. L. Ingram, Edward J. Kerns, Albert Kisthard, Harry G. McGeever, John L. McPhail, Worden Pope, Charles A. Reefsnyder, W. Melvin Strauss, Homer W. Sweet, Harvey C. Vernon, R. B. Waddington.

Bryant Electric Company, Bridgeport, Conn.—Frank V. Burton.

Wilmington and Philadelphia Traction Company, Wilmington, Del.—Frank N. Hillegas.

Potomac Electric Power Company, Washington, D. C.—H. A. Brooks.

Augusta Railway and Electric Company.—R. P. Mayo.

Consolidated Ice and Power Company, Valdosta, Ga.—W. G. Willie.

Ware County Light and Power Company, Waycross, Ga.—D. W. Newell.

Commonwealth Edison Company, Chicago, Ill.—Carlton J. Allott, L. R. Blaud, Martin Carroll, Fred Cohrs, M. E. Cotes, Charles S. Cruden, A. J. Dossman, Ferdinand Dussman, Paul M. Elder, F. H. Erickson, J. W. Ferry, Charles Foxhuber, W. P. Fryes, G. C. Gantzoo, Gerald Grove, Ervah A. Guise, T. N. Hanchette, F. J. Hennessy, William D. Hollmers, F. J. Kaeder, Maurice Kallis, T. J. Kilpenny, William J. Killhoff, Frank Klinkhamer, Edward Kraft, Henry Kropp, Olander B. Levin, C. Long, C. M. McCormick, P. McDermott, Thomas McGinnis, C. C. McLaughlin, Charles P. Meyers, John Mildenberg, Simon Miszeikis, George F. Mitchell, A. J. Nickerson, Charles G. Molzahn, W. S. Nason, John

C. O'Brien, Bernard O'Hare, Frank C. Pachaly, Charles S. Packer, T. J. Parent, J. E. Pellett, Edward D. Peterson, Nelson B. Place, J. J. Price, John Quirk, Philip C. Reidy, F. Reuse, Frank J. Rief, L. E. Ross, A. Roulston, O. P. Russ, Charles Samko, Charles E. Schrock, A. C. Schumacher, M. J. Schweig, Patrick Shea, E. Sorensen, W. G. Stafford, George H. Stout, William Troch, B. Tungeon, Fred Walton, Stephen Warans, George F. Werner, S. T. Williams, J. Winterscheidt, F. Z. Zintak.

Federal Sign System, Chicago, Ill.—James M. Gilchrist, Paul K. Judson, John J. Magee, Herbert I. Markham, F. H. Welling.

North Shore Electric Company, Chicago, Ill.—S. Anderson, Carlo Becker, R. G. Kaping, Charles Langham, L. D. Reynolds.

Economy Light and Power Company, Joliet, Ill.—Eduard Curry.

Citizen's Gas, Electric and Heating Company, Mt. Vernon, Ill.—F. M. Sinsabaugh.

Richmond Light, Heat and Power Company, Richmond, Ind.—E. A. Baily, Fred E. Schornstein.

Consolidated Gas and Electric Light and Power Company, Baltimore, Md.—Frank B. Gatchell.

Edison Electric Illuminating Company, Boston, Mass.—Miss O. A. Bursiel, A. F. McGinnis.

Meridian Light and Railway Company, Meridian, Miss.—J. A. Anderson.

The Empire District Elec. Company, Joplin, Mo.—E. Aldrich, W. T. Amos, F. C. Arthur, John Baker, M. Barnart, H. M. Beal, Charles Bottorff, J. E. Bullard, H. C. Burkhardt, R. J. Busey, J. W. Campbell, S. Capper, N. Carlisle, J. H. Carrol, C. Carson, Will Chambers, J. E. Christie, W. R. Clarke, W. O. Custer, E. C. Dietrich, Dan Douglas, R. M. Dunlap, B. M. Fast, M. G. Fristoe, Charles Fulkerson, R. H. Fuller, S. A. Gard, S. E. Gard, J. W. Georgenton, E. R. Gilstrap, Ben Greer, S. C. Greer, C. M. Halliwell, W. Hatfield, George E. Hayler, J. G. Horgan, Bob Howard, Bemis E. Jack, Charles Jones, T. Keleher, E. H. Kelso, D. H. Kirk, Gus Laber, H. Lane, J. Lefarth, Fred Lindstrum, A. Long, W. B. Magoon, G. R. Martin, C. R. Mathew, B. Minnish, G. W. Mitchell, W. Morris, A. H. Nichols, L. Nichols, R. Niver, L. O. Owen, Eduard C. Pfenning, W. Pierson, John Pifer, W. Pinson, F. C. Pratt, O. T. Rankin, J. B. Reynolds, C. B. Rhodes, F. R. Riley, F. M. Rinker, M. C. Rogers, E. W. Roll, H. C. Roth, F. Rowe, G. W. Saathoff, W. Sanders, H. A. Scott, C. A. Sharp, M. H. Short, F. A. Sigle, T. J. Silloway, John Skaggs, A. A. Stark, H. B. Storrs, S. O. Stuckey, W. G. Troutman, R. J. Walker, C. B. Watson, R. Weldy, B. F. West, A. Winfrey, C. C. Wood, L. A. Wright.

Kansas City Electric Light Company, Kansas City, Mo.—Norman J. Ambs, J. M. Arthur, Jr., F. E. Beard, A. R. Berg, Alexander E. Bettis, W. S. Bewyer, George L. Bliss, Jerome E. Brightman, Frank Burns, James V. Burns, Ed Busher, David Caleb, R. E. Chandler, H. J. Colman, Jr., D. H. Cornell, W. P. Davis, W. P. Doolittle, John T. Dysart, Chas. F. Farley, M. T. Flynn, Harold W. Foster, Harry M. Fraley, J. E. Franchere, Clyde French, Thomas D. Grayson, William G. Haitch, H. H. Halvorson, T. R. Harber, E. C. Harley, Samuel H. Hawken, Charles F. Hildreth, Orley J. Hillyer, H. A. Howery, N. L. Hurt, Frank J. Keenan, Pearl Lang, Fred Leach, Arthur T. Llewellyn, J. H. Lynn, Harry McKenney, E. E. McKimm, Clarence McKnight, Harry McSnilkin, L. E. Marshall, James F. Meister, Gailen E. Meredith, J. H. Menn, J. J. Miller, Charles A. Morgan, J. B. Morrison, David E. Nims, F. C. Niswander, Charles J. O'Laughlin, C. R. Poe, H. B. Preston, Jr., Albert A. Rall, H. Clayton Riggs, B. K. Robertson, William Scholze, Ernest E. Stigall, C. A. Thomas, Frederick L. Thornton, Leslie Van Zandt, F. H. Walters, Gordon Weaver, A. J. Wegener, L. B. Wemple, Jerrold L. Yeagle.

Grand Island Electric Company, Grand Island, Nebr.—T. H. Fritts.

Lincoln Gas and Electric Company, Lincoln, Nebr.—T. O. Kennedy, R. E. Phillips, J. E. Shuff.

Manchester Traction, Light and Power Company, Manchester, N. H.—Cleon A. Dow, Franklin S. Piper.

Public Service Electric Company, Newark, N. J.—George E. Burke, George Eichorn, Jr., Lambert J. Hartman, Charles C. Pearce, Fred J. Ulrich, Mark A. Zeek, Allan M. Pearce.

Hudson River Electric Power Company, Albany, N. Y.—Norman L. Devendorf.

Edison Electric Light and Power Company, Amsterdam, N. Y.—T. H. Pettingill.

Binghamton Light, Heat and Power

Company, Binghamton, N. Y.—L. M. Olmsted.

Edison Electric Illuminating Company, Brooklyn, N. Y.—A. G. Albrecht, Clarence S. Barnes, Walter Biel, C. W. Carter, Edward J. Cousb, B. H. Drake, George Fenn, E. A. Machold, Jeremiah J. O'Neill, John B. Rawn.

Flatbush Gas Company, Brooklyn, N. Y.—George de Beauchamp, George W. Conover, Eduard J. Devlin, John C. Devlin, W. C. Fisher, Charles A. Gould, John Guldenkirch, James T. Heffernan, Frederick O. Hewitt, Henry E. McGowan, L. J. Morrow, R. F. Price, C. W. Ruprecht, Jr., Walter P. Shields, Arthur Tjaden, Lewis S. Twell.

Buffalo General Electric Company, Buffalo, N. Y.—William C. Bingham, Philip W. Colby, George R. Kinney.

Buffalo and Niagara Falls Electric and Power Company, Buffalo, N. Y.—Edward J. Carney.

Cataract Power and Conduit Company, Buffalo, N. Y.—Harry Cash, F. A. Ellis, O. S. Karn.

Tonawanda Power Company, Buffalo, N. Y.—Frank Gordon.

Fulton Light, Heat and Power Company, Fulton, N. Y.—A. J. Weaver.

New York and Queens Electric Light and Power Company, Long Island City, N. Y.—Martin Doran, M. J. Flynn, Edward J. Hinkel, J. Johnston, Henry G. Leask, L. J. Montgomery, J. T. Pettit, A. Pollock.

Westchester Lighting Company, Mt. Vernon, N. Y.—Eduard Barth, Edward O. Baxter, Alexander A. Halley, George A. Hambright, R. M. Kellogg, G. Trenholm Macbeth, Edward J. Stein, Oscar Van Tassell.

Richmond Light and Railroad Company, New Brighton, Staten Island, N. Y.—J. E. Phillips.

New York Edison Company, New York City.—Edward W. Abrahams, Edward Adams, Charles F. Albrecht, Jr., Frank J. Andrews, Charles F. Ayers, Edwin E. Ayres, James F. Bacon, O. S. Bagley, George A. Baker, Robert Baker, J. S. Bartlett, Artolfo Bartocimi, L. S. Beebe, A. C. Bennett, F. R. Benson, A. C. Bernecker, Frederik Borch, George H. Bosman, Walter E. Boyd, Lawrence R. Boyer, F. E. Boyland, Thomas J. Brady, Thomas W. Brennan, John A. Brokaw, E. Burgin, Peter J. Buckley, Charles A. Burns, Joseph F. Byrne, D. J. Byrnes, Thomas P. Byrnes, J. A. Cabot, Raymond Cadmus, R. W. Callahan, C. M. Campbell, James L. Carroll, Joseph E. Carter, Joseph A. Caulfield, Alexander Christie, Michael J. Collins, Joseph H. Conklin, W. J. Connolly, Frank W. Cook, Albert Cooper, John S. Conlon, F. J. Courtney, O. C. T. Coykendall, H. B. Crosby, H. G. Curtis, C. F. Dandrow, F. M. Daurvey, George R. Davis, William Davis, H. P. Day, George W. DeLacey, H. Deninger, R. J. Dillon, Edward J. Doran, Charles E. Duganne, Lewis W. Dunham, George R. Durham, Edward Duyer, Charles M. Dwyer, H. E. Eagle, Adam Eisenhauer, James A. G. Ellison, Charles Engelhardt, A. Evans, F. V. Eveland, R. J. Fenton, John D. Fleming, W. Fitzgerald, Albert Flank, Franklin P. Foley, A. T. Foster, Walter H. Frost, C. H. Gattiker, Walter P. Gavit, Henry J. Gerken, F. J. Good, W. S. Gordon, William Goss, William Grabe, Daniel W. Grant, M. E. Gregson, A. W. H. Griepe, C. H. Griffith, T. Guttomsen, Daniel B. Haas, A. Hacker, Oliver Haff, G. B. Hall, S. C. Harris, George Hartmann, LeRoy Hasbrouck, Edward E. Haskell, John E. Heitmann, Jr., C. V. Hendrickson, Jr., A. J. Hill, R. C. Hinch, William A. Hoban, John G. Hogan, Charles G. Hollingshead, J. A. House, T. W. Husberg, Thomas H. Iles, H. J. Intemann, Henry Jacobs, William J. Janson, Arthur Jaques, C. L. Jenne, Ludwig Jensen, F. W. Jessen, S. Jodrey, Edward Jones, Oliver B. Jones, Edmund L. Keenan, James F. Kelly, William H. Kelly, Frank Kemly, F. P. Keniston, Joseph Kenney, Edward J. Kenny, John King, W. F. King, Clarence Greeley Knapp, John S. Knaust, W. H. Knierim, A. W. Laidlaw, John H. Lawrence, Howard W. Leitch, Charles V. Lenehan, Moro P. Lewellen, S. M. Lipman, Henry W. Lippert, Hugo Loeffler, George A. Luerssen, E. W. MacAlister, George H. McDermott, Hugh Macdonald, Walter McClure, John McGivney, John C. McLeod, James A. McMahon, Grover McMichael, J. A. McNamara, Peter C. McPherson, N. J. Macklin, W. D. Marshall, F. S. Maxwell, Thomas Melody, William S. Morrison, Hugh A. Mueller, Jr., Edith M. Myers, Frederic James Natchey, Harry W. Nietert, John J. Nolan, Joseph B. O'Brien, W. J. O'Brien, A. J. O'Connor, George F. Odehnal, B. T. O'Neill, P. A. O'Reilly, G. A. O'Sullivan, George Patrick, Alex J. Patton, A. Paul, Charles J. Pinckney, Thomas Powell, Frederick G. Prufer, Fred H. Purdue, E. J. Quinn, Louis Rapp, John H. Ray, Frank A. Regan, W. Robertson,

William H. Rogers, Jr., E. A. Rosenberg, Charles Rosmaier, H. F. Rotchford, James Rutherford, Henry E. Sachs, E. Salvesen, R. B. Sammis, William F. Sauer, George F. Scheck, Philip M. Schmidt, Emma M. Schute, John Seaman, William B. Shaw, F. L. Sherman, Bernard Silverston, Joseph F. Sinclair, John P. Skelly, Arthur B. Smith, John A. Smith, Paul B. Smith, Richard Smyth, Joseph L. Souza, Arthur L. Storm, Walter E. Storey, Charles A. Sutton, W. E. Thomas, Edward J. Tierney, Robert A. Todenhaupt, Frank T. Trainor, John J. Troy, Oscar J. Utter, A. Valenta, Henry Van Alst, E. M. Van Norden, Schuyler W. Van Rensselaer, William J. G. Veith, E. B. Vince, William Wagner, ... W. Wallace, V. V. Walsh, J. G. B. Waring, DeWitt V. Weed, Jr., J. T. Wells, C. B. Wetterholm, L. A. Whitcomb, Raymond Wilcox, James A. Wilson, A. Wohlgemuth, Thomas T. Wolley, Bernard Zufall.

New York Edison Company, New York City, Second List.—C. E. Baum, Dennis B. Cahill, H. T. Cameron, Edward J. Connelly, Andrew Corcoran, C. E. DuVall, William A. Grece, M. J. Gibson, James A. Hoban, Edgar A. Hoyt, Robert James Katzmann, John Kelly, E. D. Kent, F. J. Kramer, Otto Lissy, Olly Logsdoy, P. McCluskey, Bessie C. Morrow, M. J. O'Connor, John A. Randolph, George Ross, A. Sheinaus, George Smith, R. Spaugenberg, Edward Weiss, Margaret M Whalen Herman Whitter.

New York Edison Company, New York City, Third List.—Andrew Anderson, B. C. Babcock, August Bach, James H. Baker, William M. Bartley, John A. Blake, D. Michael Brassell, Virginio Chieffo, W. J. Chisholm, Frank A. Conlin, Joseph Corbett Louis W. Daub, Ralph B. Davis, John F. Erwin, John E. Foley, Jr., A. E. Godsey, Thomas Graney, Andrew J. Haitz, Anthony Haran, George F. Harris, Ammon W. Hebb, Thomas P. Hogan, B. T. Ingebrethsen, Charles Kahn, James J. Keliher, A. N. LaForge, Wilfred J. LaRoche, George McGivney, Charles H. J. McNamara, Charles J. McNamara, W. A. Mackenzie, William Malone, Edward F. Martin, Frederick Martin, Harry Michelsen, John J. Mooney, Michael Mooney, Louis Mueller, A. C. Newman, Horace K. J. Pearson, Herbert P. Prouchowincky, A. Schippell, Jr., William A. Starr, George P. Stock, Eldon E. Taylor, Andrew Thompson, Harry R. Torr, Benjamin Van Raden, Emile Wagner, M. J. Wagner, James Walsh, Joseph Weeks, Harold P. Westervelt, John L. Wharton, Arthur B. Wight, Chauncey V. Yates, George Yaeger, Charles Zuhr.

United Electric Light and Power Company, New York City.—Fred Cook, Christopher Diedrickson, S. Goldlust, Robert B. Grove, Hugo Heindl, Charles Hohnberg, Charles Horstmann, John Kricker, William J. Kuhl, Mitchell E. Lachiver, Robert E. Livingston, A. Leonhardt, William H. Mackenzie, William McGrath, Arthur J. McLoughlin, Thomas Morris, Edward Merkin, George S. Mitchell, Thomas F. Rowe, F. William Schuff, Michael Spring, William L. Supp, Joseph Wagner, H. Warburton, Ernest Williams, Fred C. Zerrenner.

Yonkers Electric Light and Power Company, Yonkers, New York.—Frank Blute, F. H. Buckley, T. Jeffery Cook, Thomas J. Duffy, William Foley, B. O. Fuller, Alfred S. Hohe, Alphonse J. Jacob, J. F. Kiernan, David J. Keney, Perry W. Phillips, John C. McIntyre, William F. Muller, George W. Nicholson, E. J. Reilly, Patrick F. ...ly, George R. Sankey, Raymond Smalley, William N. Smith, J. M. Vail, Alfred Verdier, Harry R. Williams.

Schenectady Illuminating Company, Schenectady, N. Y.—George E. Farnsworth.

Utica Gas and Electric Company, Utica, N. Y.—A. T. Throop.

Baker Motor Vehicle Company Cleveland, Ohio.—Emil Gruenfeldt.

Scranton Electric Company, Scranton, Penn.—G. W. Carlton.

Philadelphia Electric Company, Philadelphia, Penn.—J. B. Boley, R. E. Bostock, Henry J. Brady, Irwin C. Cairns, Charles G. Cheeseman, C. H. Collins, Thomas F. Cornog, Jr., J. C Cross, Thomas De Lacy, Eugene Diener, Clarence M. Eisenbrey, Fred ... Fisher, Harry Francis, Jr., George N. Gallena, Arthur J. Hobson, Warren M. Hauer, David Jackson, John H. Kain, William Kennedy, Jr., Charles J Lacon, Vincent A. Lacon, Clarence Le Compte, Gus. Leinhart, Jr., George H. Leonard, E. K. Lewis, Malcolm E Lewis, C. H. Litzenberg, James G. Lord, R. H. Luckenbach, Paul A. Ludwig, H. Malcolm McClure, Nicholas J. McGrath, Frank McMahon, Thomas McNamee, Joseph McVey, S. B. Miller, Thomas F. Patton, Charles Penrose, William Smith, George W. Till.

Thomas H. Turner, Charles F. Wood, W. H. Wolmus.

Allegheny County Light Company, Pittsburgh, Penn.—R. W. Addelman, Benjamin F. Anderson, A. M. Barr, C. I. Barr, Frank A. Barry, Joseph Barry, Harry C. Baxton, J. H. Beckey, Vincent Berardi, William Bersey, Charles R. Bigley, Paul Boldt, John Booth, Clair V. Brehm, William Brown, James J. Brownlee, George Bubenheim, Williams Buhl, Edwin H. Buscher, Thomas F. Campbell, George H. Carmack, H. Carpenter, Charles Chapman, James Chase, C. L. Clark, W. A. Clark, H. W. Cleland, Charles S. Colmer, George B. Confer, Ferry D. Conner, A. N. Conrad, A. J. Corbin, Frank M. Cook, Elmer L. Coombs, C. W. Davis, Joseph J. Davis, Thomas Davis, C. E. Dotson, John J. Dougherty, Howard Eberhart, A. E. Ecklund, Edward Egler, Chris. A. Evers, Samuel G. Fair, T. Carl Feist, Frank Ferrero, John W. Finlay, George E. Firth, C. M. Fluke, S. W. Ford, John M. Froelich, A. C. Genor, A. C. Gerhard, W. S. Gibson, Charles W. Gilbert, L. A. Gilliland, R. F. Gooding, W. N. Graham, J. M. Graves, Lawrence W. Griffith, G. H. Grubbs, William Hackwelder, E. A. Hall, Ellis N. Hall, G. E. Hampton, Joseph P. Hanlon, F. E. Harper, E. F. Harrison, Joseph H. Harrison, William J. Hartigan, Edward F. Hartman, Frank A. Henry, Richard Herd, Howard A. Heslep, G. L. Higley, H. J. Hoeveler, C. H. Horn, Charles C. Hotchkiss, John M. Huselton, Bert Hubner, John H. Inks, John T. Johnston, H. V. Jolliff, W. P. Jones, Robert A. Kaler, Leo Kaminski, William A. Keating, William B. Keck, F. Kelton, Crawford H. Kennedy, G. J. Kennedy, Richard F. Laney, G. E. Leese, Fred W. Lehman, Horace Levine, W. H. Lindsay, Max Linn, D. Paul Lockard, H. C. Lorenz, Daniel Lynch, W. W. McCleary, Charles B. McCune, J. P. McDonald, W. C. McFalip, J. E. Macdowell, C. C. Mann, J. Frank Martin, Charles H. Mason, Dan. S. Maurer, H. H. Miller, Maurice L. Moffet, W. M. Mooney, Henry Moore, T. J. Moran, J. A. Morgan, H. L. Morrill, Harry N. Morrill, J. J. Morrison, H. N. Muller, R. H. Mums, T. H. Munroe, E. A. Murray, F. W. Myers, A. Nelsen, John Onnes, Edward A. Opferman, Joseph Opferman, Walter J. Orston, George D. Paisley, C. A. Panner, Dominick D. Pastin, F. B. Patterson, William Pohl, F. K. Porter, D. W. Repine, John N. Reynolds, Alvin H. Rick, R. A. Riffle, J. T. Riley, William Riley, E. R. Roberts, Walter M. Schauer, Joseph Schinto, J. O. Shidle, William H. Shuck, John Hays Smith, Matthew A. F. Smith, John G Snyder, John N. Snyder, John Spielman, Walter Spielman, Chauncey H. Steele, I. W. Steiner, Felix H. Stone, John Store, Sam Talis, John R. Taylor, M. J. Taylor, R. Wallace Thompson, J. F. Torrence, John Vogel, W. E. Walker, C. W. Ward, J. Paul Warner, H. J. Welsh, Michael P. Welsh, R. A. Westfall, J. E. White, C. W. Wilkins, H. C. Wilkinson, William R. Wilson, Harry Wiseman, Howard H. Wood.

Allegheny County Light Company, Pittsburgh, Penn., Second List.—James H. Alspach, S. H. Black, M. H. Black, C. R. Crossland, Thompson Cummings, R. M. Dale, J. L. Geary, William W. Handy, William H. Hartman, T. N. Hazlett, W. B. Herbst, H. H. Hess, Fred G. Kuhn, C. W. Lepper, W. J. Livingston, T. A. McAleer, James W. McKelvie, J. E. McKirdy, C. H. McKnight, Stewart Miller, R. S. Orr, E. N. Patterson, R. B. Robinson, R. H. Roughen, Arthur Sayne, H. L. Skinner, John S. Sloan, John H. Werth, William F. Wettengel, Clyde R. Van Wickle, Albert L. Zapf.

Narragansett Electric Lighting Company, Providence, R. I.—Abel Reynolds.

Bristol Gas and Electric Company, Bristol, Tenn.—Richard A. Brooks.

Beaumont Ice, Light and Refrigerating Company, Beaumont, Texas.—H. P. Jirou.

Consolidated Light Company, Barre, Vt.—Earl A. Young.

Whatcom County Railway and Light and Power Company, Bellingham, Wash.—Robert W. Lindley.

Seattle Electric Company, Seattle, Wash.—G. E. Quinan.

Wenatchee Valley Gas and Electric Company, Wenatchee, Wash.—H. W. Soderling.

Equitable Electric Light Company, Lake Geneva, Wis.—J. S. Allen.

Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—Albert H. Sikes.

Cape Breton Electric Co., Ltd., Sidney, N. S.—Earle L. Milliken.

Hamilton Electric Light and Power Company, Hamilton, Ont., Can.—George D. Fearman, Thomas F. Kelly, Louis W. Pratt.

Toronto Electric Light Company, Ltd., Toronto, Ont., Can.—John R. Bibby, Archibald G. Milton, J. Teasdale.

NEWS OF THE SECTIONS

THE HABIT OF GROWTH

The Class B members of the Association are now twice as numerous as all the other classes put together, and out of 7500 are over 5000 strong. With the rapid increase in the number of Company Sections and the growth of the sections formed already, it seems fair to assume that these proportions will be maintained. Such an enrollment would indicate that the principles followed in forming both Class B and the Company Section have been justified.

If this is the case, it is pertinent to raise two points, one relating to the matter generally, the other to the individual in membership. We believe that there are still a great many companies where a Section would be found of a great deal of service and benefit to all concerned. Why are not such sections formed? Is there any local objection to them? Have such companies studied the matter and inquired as to results elsewhere? If it is good to organize the industry, is it not well to organize within the company? Does not the very growth and widening range of the business require that men should acquaint themselves with all the new problems and solutions? Is this not best done by getting together?

As for the individual members, it is reasonable to suppose that the great majority of us are in the Association because of the personal good we can get out of it. A few may be in to please somebody else, but where that is the case no great good can come either to the person or to the Association. It is pleasant, and broadly true, to picture the membership moving forward as a great volunteer army, full of enthusiasm, loyal to the cause, eager to be efficient. But an army is made up of units, and back we come to the individual. In a growing industry—and that is ours emphatically—the individual must grow, too, or be left behind. Laggards and stragglers are of no use to anybody, least of all to themselves, but sometimes there does not come until too late the sad realization of the fact that one has lost touch and step in the march of progress—that by mental lethargy or want of activity one has allowed the industry to grow away and be imperfectly understood.

To each and all of us, in Company Section or out of it, the work and literature of the Association afford the opportunity of growth. Once the habit of growth is formed it becomes easy, natural and unconscious. If we grow, the industry has its rewards for us. If we do not grow, relatively we shall shrink. Let us all cultivate the habit of growth for its own sake, and then, to use the scriptural phrase, most likely "the other things will be added unto you." There is an "unearned increment" which comes to all of us, sometimes when we sit still and do nothing, but always and assuredly when we are receptive of new knowledge and open and responsive to outside influence an stimulus.

Physiological Effects of Electricity

The regular monthly meeting of the Philadelphia Electric Company Section was held in the Assembly Room, 1000 Chestnut Street, Philadelphia, Monday evening, March 20, 1911. Dr. Edward Anthony Spitzka was the speaker of the evening. He is Professor of General Anatomy in the Jefferson Medical College, having gone to Philadelphia from Columbia University, in which institution he occupied for many years a position of importance, especially in connection with investigations on the anatomy and function of the nervous system, particularly the brain. His contributions to scientific bodies on this subject are known throughout the scientific world. He is held in high esteem because of the thoroughness and accuracy of his work. Dr. Spitzka, being a student of the action of electricity on the human body, and having conducted exhaustive experiments in the changes produced in the body by electricity, is a strong advocate of electrocution.

There were present at the meeting representatives of a number of medical societies, particularly of the hospitals of Philadelphia, prominent physicians and engineers from Philadelphia and New York, as well as physicians connected with large industrial establishments.

Dr. Spitzka covered in his lecture the full range of the effects of electricity on the human body, from the effects of lightning to the usual current used for industrial and residential purposes. He brought out many new and interesting discoveries regarding the effect of electricity on the human system, which were fully illustrated by lantern slides. Dr. Spitzka gave many interesting experiences, based on his own investigation, of some 57 electrocutions in the various states in which electrocution is used as a means for capital punishment. In the majority of these cases Dr. Spitzka had made post-mortem examinations. Of chief interest was the statement that the temperature of the body in many instances was raised as high as 129° Fah. immediately after electrocution.

Regarding accidents which may occur in the commercial use of electricity, many slides were shown of various types of electric burns, their history was stated, and various methods of practising artificial respiration, which would, in the majority of cases, save the life of the injured, were explained.

The lecture was discussed by many prominent physicians, and they were unanimous in their praise of the splendid work that is being done by Dr. Spitzka in this particular field, and the benefit which will naturally result in the saving of life. The discussion was also entered into by many prominent electrical engineers, among them Percy H. Thomas, of New York, and W. C. I. Eglin of Philadelphia, who asked pertinent questions from the practical standpoint, all of which were ably answered by Dr. Spitzka. The lecture was unique, because of the fact that it is the first time such an address has been presented before an engineering society.

Prior to the meeting an informal dinner was held, at which all the out-of-town visitors were entertained, the table being spread for fifty covers. The table was beautifully decorated with festoons of electric flowers, an electric fountain and baskets of flowers illuminated by miniature electric lamps. The usual Philadelphia hospitality was very conspicuously shown.

The best evidence of the interest taken in the lecture is the fact that there were over four hundred in attendance.

Business Methods and Wiring Methods

About 425 members attended the April meeting of the Commonwealth Edison Branch of Chicago at Handel Hall on Thursday evening, April 6. In opening the meeting, the chairman announced that the new Section button was on sale in the secretary's office; and a colored picture of the button was flashed on the screen. A large number of the members present at once placed their orders for these buttons, and it is hoped that every member will soon be wearing the emblem of the branch.

The programme for the evening included a series of three interesting papers, as follows: "An Educative Force in the Electric Service Field," by Mr. H. A. Seymour, of the Advertising Department; "Methods of Handling Business to Give Service," by Mr. Harold Wright, of the Contract Department; "Interior Wiring and Inspection," by Mr. A. P. Good, of the Engineering Department.

Owing to the length of these papers, it was necessary to dispense with the customary intermission and discussion in order that the following entertainment programme could be given: Cornet quartette, Messrs. Suter, Scovil, Bouten and Paulitz, accompanied by Mr. E. G. Bildhauser, piano; solo, Mr. F. McKenna, accompanied by Messrs. Rabe, piano, and C. H. Bucher, violin; ten minutes of caricature, Messrs. R. A. Ward and R. A. Fischer; N. E. L. A. quartette, Messrs. McGovern, Schaeffer, Brown and Fergusson; impersonator, Mr. Wm. O'Brien.

Mr. G. L. Knight, who had the honor of being the first chairman of the Brooklyn Section, was present, and in response to the invitation of the chairman gave an interesting talk in which he described the very healthy and gratifying growth of the Class B membership in his Section.

During the meeting a resolution was adopted that the present and former chairmen of the Branch be presented with gold buttons in conformity with the practise followed in the parent Association.

Great enthusiasm was aroused when the Chairman announced that the membership had increased to 927, this being an increase of 91 per cent since the present membership committee began its campaign.

Empire District Company Section

With very little preliminary work the new Section of the Empire District Electric Company was formed at Joplin, Mo., on April 10. The general manager of the company, Mr. M. R. Bump, says that there are approximately 175 regular employes of the corporation, and as the new Section starts with between 90 and 100 members, it will be seen that a remarkably high percentage of enrollment has been secured, showing a most commendable spirit on the part of the employes.

It was decided to elect a temporary set of officers to hold office until October 1, by which time all the details of organization will be fully perfected. A constitution was adopted which is practically a duplicate of that of the Section of the Denver Gas & Electric Company. The officers are: President, George Hawler, general superintendent; vice-president, S. E. Gard, chief engineer, Riverton plant; M. G. Fristoe, purchasing agent. These together with Messrs. J. H. Harsh, manager of the new business department, and Mr. Russell Niver, the Webb City foreman, constitute the board of directors. About 50 were expected to attend the first meeting, but no less than 85 were present and the proceedings were quite enthusiastic.

The Theory of Transformers

At a meeting of the British Columbia Electric Section, held on Tuesday, February 21, 1911, at Vancouver, B. C., Mr. J. G. Lister, past president of the Section, gave a lecture on the "Theory of Transformers." In a most interesting manner, he traced the evolution of the transformer from the historic "Ring" form of Faraday to the most modern type as in use to-day, illustrating his prints with blackboard diagrams and very clearly explaining the questions asked in the discussion that followed.

The Section hopes to hear from Mr. Lister again at an early date.

The April Meeting of the Brooklyn Company Section

The April meeting of the Brooklyn Company Section was held in the Johnston Building, Monday evening, April 3, the Chairman, Mr. E. A. Baily, presiding. The programme for the evening included a paper by Mr. W. C. Pike on "Practical Accounting," which was of great interest and was thoroughly discussed by members of all departments.

Following the paper an extremely interesting talk on "The Development of the Motor Car" from its beginnings in 1600 to 1896, when it began to assume its present form, was given by Mr. Parker H. Kemble, the editor of the Section Bulletin. The talk was fully illustrated by lantern slides made from old prints and engravings, and furnished the section with data as to a side of the motor car concerning which comparatively little is known.

Mr. E. E. Higgins of the Anderson Company then presented a very thorough exposition of "The Modern Electric Vehicle," using the stereopticon to illustrate the various points of construction and operation.

Besides these papers and addresses, the programme for the evening also included moving picture films, illustrated songs, a very snappy vaudeville entertainment, and the usual refreshments and music.

The attendance was as usual between 400 and 500.

This was the last of the Section meetings of the year, and the members will not rally again until the convention on June 31, which will be held as usual at the Oriental Hotel, when there will be other "sayings" besides those of the sad sea waves.

Efficient Electric Heating Devices

The regular monthly meeting of the North Shore Electric Company Section was held Tuesday evening, March 28, 1911, in the meeting room of the Commonwealth Edison Company, Chicago, with 50 members present; Chairman PenDell presiding.

The secretary read an invitation from the chairman of the Commonwealth Edison Company Branch extended to all members to attend any or all of its meetings.

Announcement was made that the membership of the North Shore Electric Company Branch was 129, a gain of three since last meeting.

The secretary requested members to reply to the letter sent out asking whether publications were regularly received and informed the members that each member whose dues were paid was entitled to one copy of the *Solicitor's Handbook* of that year's issue in which the member joined.

Mr. Cushing announced that at the next meeting the Section would be addressed by a representative of the Westinghouse Electric Company, who would talk on lightning arresters and transformers.

Mr. Chas. P. Madsen, electrical engineer and designer for the Pelouze Electric Heater Company, addressed the members concerning the essentials of efficient heating devices. Mr. Madsen dwelt on the adaptability of the various appliances, showing the different makes and explaining the methods of construction; and his very instructive talk was listened to with close attention.

Distributing Lines

The eighteenth regular meeting of The Utah Light and Railway Company Section was held in the company offices Wednesday, March 22, 1911. Meeting called to order at 8.15 P. M. by Chairman W. M. Scott, with 21 members and six visitors present.

Mr. C. H. Jenkins presented a paper on "Construction and Regulation of Distributing Lines." The subject was then discussed in open meeting.

Mr. D. B. McBride presented a paper on "Relation of an Arc Department to a Modern Central Station." This was also discussed.

The committee on questions and papers presented two questions, which were referred back to secure answers.

A Busy Month at Baltimore

The winter work of the Baltimore Consolidated Company Section is proving of great educational value to the section members. The course of ten lectures, delivered by Dr. John B. Whitehead, Professor of Applied Electricity at the Johns-Hopkins University, was concluded on April 4, when the subject was "Principles of Illumination."

At the meeting on February 28, 1911, Mr. H. L. Parker, illuminating engineer of the Consolidated Gas, Electric Light and Power Company, lectured on "Interior Illumination." The lecture was illustrated with lantern slides.

At the meeting on March 14, 1911, Mr. R. H. Tillman, who is in charge of the company's industrial power department, lectured on "Private Plants."

On March 28, 1911, Mr. William Schmidt, Jr., secretary of the company, lectured on "Corporation Accounting." It will be seen that the programme was varied enough to suit all comers and all members.

New York Companies Section

As evidenced by the list of new members given elsewhere in this issue, the New York Companies Section has been enjoying a marvelous growth the past month; and it has already reached the 1000 line in membership, thus becoming the "banner" Section. In fact, at least 50 more applications have been received since the list went to press. At the meeting of the Section held in the main auditorium of the Engineering Building, on April 17, a huge facsimile thermometer was shown with the ratings and positions of the various leading Sections indicated to the left of the ordinary scale. It was very effective and made a great hit.

The same evening and at the same place, before an audience of over 500, "Buffalo Jones" delivered a thrilling illustrated address, accompanied by moving pictures, on the trapping and taming of wild animals. It was a huge success.

The Section has just begun the publication of a handsome 12mo. bulletin, with cover. The first issue for April contains 24 reading pages full of excellent matter, both as to the Section and the affairs of the eleven local companies included. The back cover gives the complete list of

officers and a list of the members grouped by the companies to which they are attached.

History and High Winds

The regular monthly meeting of the Philadelphia Electric Company Section was held on Monday evening, April 17, 1911 The meeting was one of the most enthusiastic of the season. Mr. George F. Peifer, chief engineer Station F, read "A Historical Sketch of the Philadelphia Brush Station," which was the first electric light station operated in Philadelphia, and with which Mr. Peifer has been connected as chief engineer since its beginning, or for the past thirty years.

The many troubles of the pioneer lighting companies were outlined, and the gradual increase in size in both the electrical and steam units was given, and illustrated by numerous lantern slides. One of the most interesting facts brought out was that a serious accident in either the electrical or the mechanical part of this station was unknown, and that much of the apparatus installed thirty years ago was in active use, or capable of being used, until six months ago, when the station was reconstructed and changed to a motor generator plant.

Mr. Peifer's paper was very favorably commented upon, particular stress being laid on the magnificent condition of the engines and shafting, it being stated that after thirty years of continued use it was impossible to determine any difference in diameter in the shafting between the portions working in the bearings and the unused parts.

The second paper was on "The Phenomena of Cyclones, Tornadoes, Etc.," by Mr. George S. Bliss, section director of the United States Weather Bureau. Mr. Bliss demonstrated by his talk and with the use of lantern slides the theory of wind disturbances, from enormous movements, such as trade winds, etc., to purely local disturbances, such as tornadoes. The talk was a popular one, and so expressed as to be understood by everyone present. As a section of Philadelphia had been recently visited by a tornado, the remarks on this variety of wind disturbance were particularly interesting.

The statement that a tornado column could not exist without a peripheral velocity of between 200 and 400 miles per hour was appalling. While the fact that the action of the tornado reduces the atmospheric pressure from 2000 pounds per square foot to as little as 1000 pounds per square foot explained very graphically the enormous destructive force of such a disturbance. Mr. Bliss stated that it would be impossible under any circumstances to construct buildings, pole lines, etc., that would withstand even the mildest of tornadoes, under which class the tornado at Tacony was placed.

Mr. C. J. Russell, of the Philadelphia Electric Co., described the course of the recent tornado in the vicinity of Tacony, which was purely local, covering a path approximately two miles long and not more than 100 yards wide. All the trees, telegraph and electric light poles and buildings in its path were seriously damaged. The Pennsylvania Railroad signal tower at Tacony was lifted from its foundations and carried 100 feet. The storm destroyed all the electric wires radiating from generating station "J" so that the station was completely shut down.

A remarkable piece of aerial line construction was accomplished within the next six days, as some seventy 65-foot poles were erected and sixty miles of wire strung, a large portion of which was No. 0 in size. Service

was reintroduced to the principal consumers within twenty-four hours by the installation of about one mile of three-conductor cable buried about fifteen inches below the surface of the ground. The entire service was restored within five days, and within six days the station was operating normally. This is considered by experts throughout the country as the most gigantic piece of line construction ever accomplished in so short a time.

Mr. Russell spoke in a most complimentary manner of the men employed in the work, as it was accomplished under the most trying conditions, the weather being particularly cold, and high winds prevailing during the entire week. There were many visitors present, among them representatives of the Pennsylvania Railroad Company, the Bell Telephone Company, the Electrical Bureau of the City of Philadelphia.

The meeting was preceded by the usual business meeting, at which the membership committee announced a total membership of 449, and the Prize Award Committee announced the award of two prizes. The first was awarded to Mr. J. W. Sylvester, who suggested the placing of ducts in the foundation walls of building operations for underground service, instead of waiting for service orders, which usually arrive so late that the duct has to be introduced at considerable damage to the property. The second prize was awarded to Mr. Frank T. Adams, who suggested a change in the numbering of the working order system.

An amendment to the constitution was also proposed, which provides for the appointment of two honorary members of the Executive Committee. This amendment will be voted on at the next meeting, which will be the annual meeting in May.

Activity in Georgia

The executive committee of the Georgia State Section convened at Augusta the first week of the month, and held a very satisfactory meeting. The membership has reached a total of 42, and it is expected to double this in the next six months, before the annual convention is held the last week of September at Columbus.

The Edison Medal

Members of the Association have been invited to attend the exercises of the American Institute of Electrical Engineers in the Engineering Societies Building, New York City, on Tuesday, May 16, at 8.30 P.M., when the Edison gold medal for meritorious achievement in electricity will be awarded to Mr. Frank Julian Sprague. Ladies are included. There will be an elaborate ceremony and four speeches by prominent men. The medal has been awarded once before to Professor Elihu Thomson. The medal was founded in the Institute about five years ago by the friends and admirers of Mr. Edison to celebrate the twenty-fifth anniversary of the incandescent lamp.

A Scranton Section

At the present moment steps are being actively taken by officers of the Scranton, Pa., Electric Company for the formation of a Company Section, and it is quite likely that an organization may be effected before the end of the current month. There are already several Class B members enrolled, and as the company is growing rapidly under aggressive management and has already between three and four hundred employes, a large and healthy section is confidently expected.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

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QUESTION BOX CLASSIFICATION

THE INVENTOR'S OPPORTUNITY

"Men my brothers, men the workers, ever reaping something new,
That which they have done but earnest of the things which they shall do."

There have been a number of questions presented and discussed in these pages referring to ice-making by central stations, and the supply of energy for refrigeration and ice-making purposes.

Is there not another phase of this general subject, which would warrant more consideration than it so far seems to have received? We refer to the cooling of homes in summer. In the light of engineering achievements and manufacturers' triumphs of recent years, a comparatively inexpensive device which at small operating cost could be made to cool the average living room, by reducing the temperature from 10 to 15 degrees, does not seem an engineering impossibility. Such an appliance, under conditions as outlined, and used as it would be in the summer season, would certainly furnish the central station an exceedingly desirable addition to its residence load. Moreover, any appliance, the use of which will add materially to the revenue from residences, is certain to prove for reasons well understood, of especial value to the electric lighting industry, and it would seem as if it might certainly be worth while to devote energy and effort to the development of a house-cooling device such as is herein indicated.

A NEGLECTED THEME

Of all the subjects recently discussed through the "Question Box," none have been of greater general interest and value than those relating to the science and practise of accounting; and this suggests a recommendation to the various company sections, especially those which publish bulletins.

Has this important phase of our industry been given adequate attention in the papers presented before company sections, and published in their bulletins? We think not. There are exceptions, but in the main, accounting subjects have received little consideration in connection with company section activities.

The topics exploited have generally been of an equipment, operating or commercial nature. It is hardly necessary to point out to any well equipped central station employe the importance of some knowledge of the essentials of accounting. No man can hope to be a successful bureau or department head, not to mention any higher office, who has not some knowledge of the basic principles and present day methods of accounting.

Our suggestion, therefore, is that when company section activity is resumed after the summer vacation, more attention be given to this element of our enterprises.

And do not be afraid that the subject is a dry one. With the right treatment it can be made at least as interesting as dissertations on rate-making, descriptions of sub-stations, or discussions about dynamos.

PLENTY OF WORK AHEAD

In the February issue, under caption "New Sales Methods," we patted ourselves very nicely on the back, telling something of how central stations are securing large power business by improved scientific sales methods. Every word of this statement is true, and the methods described, in conjunction with the fixing of competitive rates for electric energy used for power purposes, have resulted with many stations in much additional profitable power business.

Nevertheless it is also true that we have only gone a few steps on the way—hardly scratched the surface as it were—and the number of possible power customers of the central station, who are not at present customers, is still legion.

This fact is called forcibly to our attention by question 19—50, and the replies received, most of which are not printed.

This inquiry asks: "Have member companies been successful in securing power contracts for the complete operation of (a) breweries, (b) laundries?" A number of large cities have been heard from, answering this question in the negative; and so far but one case has been reported of a central station supplying all power used in a brewery.

We realize the difficulties of doing business with enterprises of this nature, where the use of steam in quantities is an essential factor in the manufacturing process. Nevertheless we have sufficient confidence in the inherent and potential superiority of the central station system and in the ingenuity and resource of the personnel of our industry, to believe that the time is not far distant when the central station will be able to handle readily a situation of this kind, with advantage to its customer and profit to itself. We even feel that, under present conditions, more of this business could be secured by large central stations if they went out after it energetically, aggressively, and with a determination to scientifically solve the difficult problems presented.

At any rate it will be some time yet before our power engineers will be in the position of Alexander, sighing because there are no fresh fields or new worlds to conquer.

ELECTRIC VEHICLE INFORMATION

The electric vehicle is well in the forefront of the central station line of business battle these days, and activity in this field is interestingly reflected in this month's BULLETIN by three *Question Box* inquiries and their replies.

One questioner complains that he has recently been obliged to provide five different charging plugs for electric vehicles and asks what attempt is being made to standardize in this respect.

He is answered from several sources to the effect that the matter of standardization is now under consideration by a committee of the Electric Vehicle Association, appointed especially for that purpose, that this committee

is in touch with the vehicle manufacturers and is sanguine of accomplishing its aim. This news is intrinsically pleasing, and is also gratifying as a slight indication of the real need for this new but important organization, and of the beneficent results to the electric lighting industry likely to accrue from its continued activities.

All the replies to question 29—1, as to the relative advantages of one or two motors for heavy electric trucks, do not agree, and perhaps this was hardly to be expected. The offerings on this question are particularly interesting; the subject is certainly a live one, and invites further investigation and study. As far as "Question Box" contributions are concerned, the unbiased reader is left in the exact position indicated by Mr. Poole, Editor of *Power*, in the concluding paragraph of his answer. Says he: "The abstract question seems to boil down to the classic offer: 'Ye pays yer money and takes yer choice.'"

Another question answered in this issue requests the experience of member companies with the Edison battery for vehicle work. A sufficient number of replies has not been received to justify the formation of judgment as to degree of success so far achieved by central stations with this battery, and further replies on this timely topic will be welcomed.

Possibly the most interesting experience is that related by Mr. Yawger of Rochester, N. Y., who in twelve months covered 7700 miles in an electric vehicle equipped with an Edison battery. He states that no special expert attention was given the battery and that no repairs whatever were required. The only defect which developed was that cold weather seemed to have a deleterious effect upon battery efficiency.

ANSWERS

BOILERS, ENGINES, TURBINES

5—10. What does it cost member companies to clean Babcock and Wilcox Boilers?

(Other Replies in March BULLETIN.)

A. E. Bettis, Engineering Department, Kansas City Electric Light Company, Kansas City, Mo.—We are operating five Babcock and Wilcox boilers, vertical header type, capacity 500 horse-power on our district steam heating system, and use a green fuel economizer; taking water direct from city mains. We do not get any returns back from our heating system to the boilers. The feed water used is considered fair, having about 13½ grains of solid matter per gallon. We are also using boiler compound in our feed water.

The boilers are cleaned once in every three weeks. The cleaning includes draining boiler, and cleaning drums and tubes, removing caps, redressing same, recapping boiler, filling and testing it out. The work requires three men, and consumes approximately three and one-half days testing it, at a total cost of $23.50.

5—11. Will member companies please give us their experience in operating boilers under the following conditions: Our boilers are set to blow off at 125 pounds pressure, and this is the pressure carried through the peak of the load. After midnight when the load is light, and during the day, it is the custom of our firemen to allow the steam to fall to about 80 or 90 pounds. Is it or is it not more economical for us to hold the pressure at 125 pounds all the time?

Herbert A. Wagner, Vice-President, Consolidated Gas, Electric Light & Power Co. of Baltimore, Baltimore, Md.—An engine running many hours a day with a load far less than its rated or most economical load at a stated pressure, will generally take less steam if the pressure is carried at a lower point during the hours of light load. Whether or not there will be a substantial saving by the reduction of your steam pressure from 125 to 80 lbs., will depend altogether on the character of your installation and your operating conditions. I would suggest that you take the matter up with the makers of your engines, asking them to give you the most economical steam pressures for your engines at different loads.

New London Gas & Electric Company, Charles A. Roberts, Superintendent, New London, Conn.—When using a turbine, greater economy can be secured at all times by maintaining a high steam pressure. However, when operating a reciprocating engine, it would seem an advantage to drop the pressure under light load, for it is harder for the governor to keep the engine under control when the steam pressure is high, and the engine is apt to race and strain the valves and other parts. We believe it is the custom to reduce the steam pressure on light loads.

6—3. Based on a 100-kilowatt unit, supplying a load varying from 12-kilowatts to 80-kilowatts, with 12-kilowatts for about ten hours out of twenty-four, which unit would give us the best all-day efficiency:—An A. C. condensing steam turbine unit, a direct connected, single valve, high speed unit noncondensing, or a medium speed, four-valve noncondensing unit?

What is the efficiency of each of these units in pounds steam per kilowatt-hour for ¾ load, for ½ load, for ¼ load, for 1/5 load, for 1/10 load?

(Also answered in February BULLETIN.)

George S. Blankenhorn, Engineer, Allis-Chalmers Company, Milwaukee, Wis.—The curves showing the comparison of steam consumption for the three different types of machines, are based on results of tests, and average of guarantees furnished the United States Government, by several reputable concerns. The above questions are answered by the use of these curves.

(a) Pounds steam per kilowatt hour with loads of 80 and 12 kilowatts, respectively.

	80	12
Turbine condensing	32.6	91.7
Corliss Engine	38.8	166.6
H. S. Engine	44.2	212.5
Turb. noncondensing	45.6	180.0

Note: The consumption for these very light loads is determined by dividing the required load into the total steam per hour, taken from the total steam curve.

The all day efficiency would be as follows, considering each machine loaded as mentioned in question (a).

Turbine condensing	(91.7x12x10)÷(32.6x80x14)=47500	lbs. per 24 hrs.
C. Engine	(166.6x12x10)÷(38.8x80x14)=63500	lbs. per 24 hrs.
H. S. Engine	(212.5x12x10)÷(44.2x80x14)=75100	lbs. per 24 hrs.
Turbine noncondensing	(180. x12x10)÷(45.6x80x14)=72700	lbs. per 24 hrs.

From the above figures, the turbine condensing will use 75 per cent as much steam as the Corliss engine, and 63.2 per cent as much as the high speed engine. When the three units are operating noncondensing the Corliss engine will use 84.5 per cent as much steam as the High Speed engine, and 87.3 per cent of that amount required for the turbine.

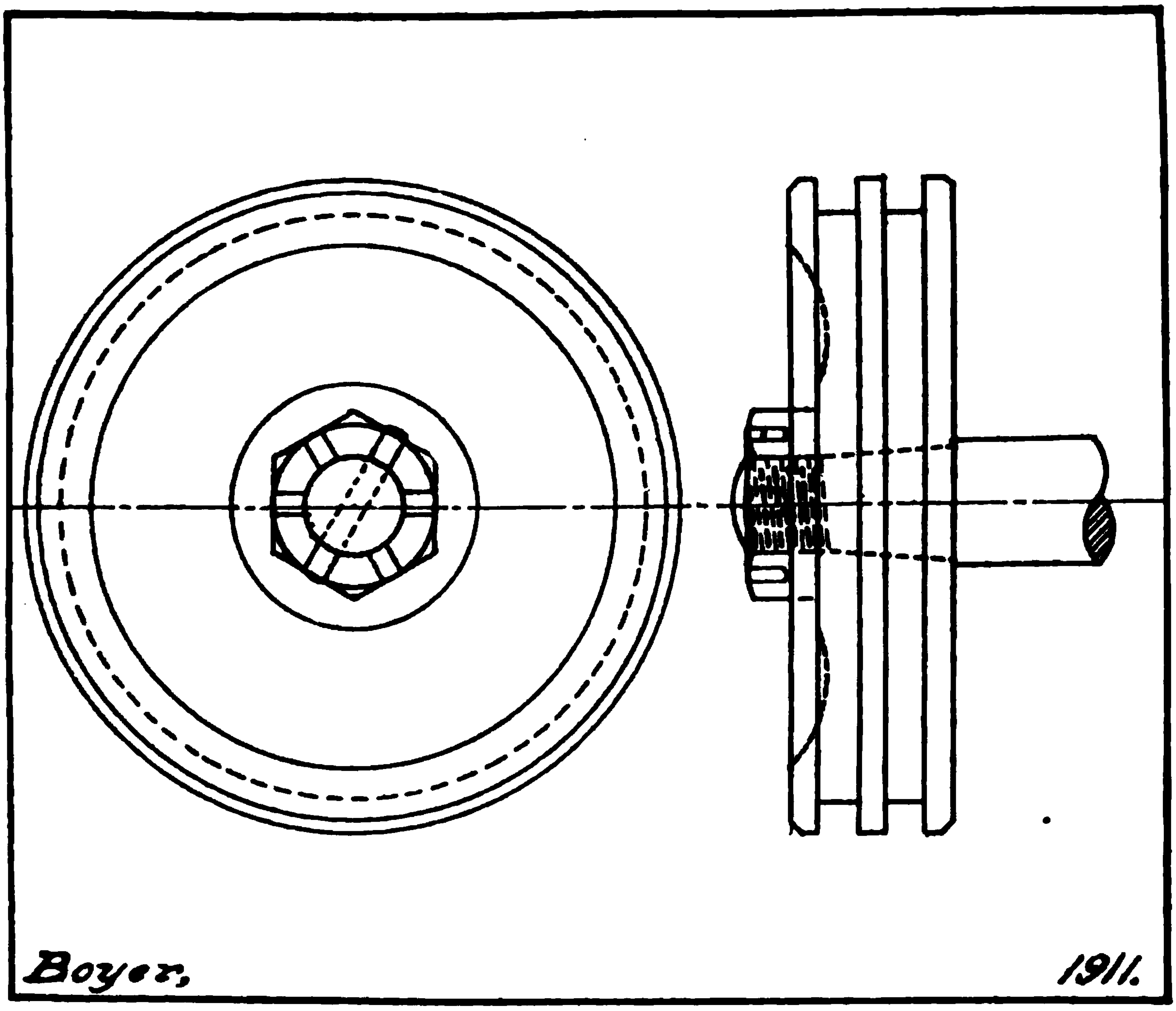
(b) The answers to these questions may be found by the use of the curve.

6—5. How should a steam-engine piston body be fitted to the rod? Should rod and hole in piston body be slightly tapered and piston forced on rod, and up against a flange on rod; or will a cylindrical rod and cylindrical hole in piston body, fitted loose enough so that before nut is tightened, the piston can be rotated on the rod, and when nut is tightened, this only to keep piston body from rotating, be equally satisfactory?

H. O. Boyer, Chicago, Ill.—Both methods of fastening the piston body to the rod, as suggested in the question, are used. A good method is to turn the rod down, tapering about 1 to 12. The piston body is then forced on by means of a slotted nut, after which the rod is drilled and a pin inserted, as shown in the sketch on page 6. Advantages: nut cannot work off; piston body cannot rotate on the rod.

Thomas H. Buck, Machinist, Philadelphia Electric Co., Philadelphia, Pa.—In fitting a piston body to a rod, the best method is to have the rod turned taper, with a flange. The amount of taper allowed is optional, but it is con-

sidered good practise to allow a taper of one-eighth of one inch to the foot, the rod to be so turned that when it leaves the lathe and is put into the piston head, it will come within one-eighth of an inch of the face on the piston head. This is left for driving purposes, and will insure a good tight fit. Care should be taken that the small end of the taper on the rod should be 3/16 of an inch



below the piston head when the rod is forced home, so as to allow the nut to have a good solid face to bear on. A rod fitted to a piston head in the above manner is perfectly reliable, and if the work is well executed it will never cause trouble, expense and loss of time by working loose in service.

A parallel fit on a piston rod and head is not good practise, as it is apt to come loose after a few weeks' service, and may cause a disastrous wreck.

Frank M. Roth, Assistant to Chief Engineer, Station 1, Commonwealth Edison Company, Chicago, Ill.—In any case regardless as to whether a taper or straight fit is used, the piston body should make up on the taper before flange is reached, or in the case of a cylindrical rod, the piston body should be a pressed fit on the rod to the shoulder, and by no means should the nut be depended upon entirely for preventing the piston body from turning. From a practical standpoint, the taper rod with flange is preferable.

GENERATORS, CONVERTERS, SWITCHBOARDS INSTRUMENTS

11—20. What is the practise of transmission companies having oil switches on high-voltage circuits (15 and 30 K. V.) in inspecting and changing the oil? Is the sediment which forms in the oil detrimental to their operation?

(Other Replies in March BULLETIN.)

Connecticut River Transmission Company, E. J. Richards, General Superintendent, Fitchburg, Mass.—On our 6, 13, 19 and 66 kv. oil switches we make inspections, depending on the use of the switch. In any event, all switches are inspected annually, contacts cleaned up, oil tested and treated, if necessary,

and we keep monthly records of the number of times that the switches are operated. We have not definitely established our practise as yet, but believe that oil switches should be examined at frequent intervals, the contacts should be filed up and lined up; oil should be filtered and dried out if test shows evidence of moisture.

British Columbia Electric Company Section, National Electric Light Association, Vancouver, B. C.—Our practise is to test the oil once a week in all our oil switches, by taking out a sample and measuring its dielectric strength with a spark gap of from .15 inches to .30 inches, and to also make this test in any switch immediately after it has been opened on a short circuit or other trouble. A series of tests made on a sample taken from one switch which had opened a severe short circuit, showed very low resistance at first, which gradually increased until forty-eight hours afterwards, when the resistance came back to practically normal. This was probably due to the free carbon formed in the oil by the arc at the time of rupture, which finally settled at the bottom, and the natural deduction is that the oil should be filtered as soon as possible after a break. Our experience is that the only way to make sure of the condition of the oil is by frequent testing, and we are installing a high voltage testing set for this purpose.

OVERHEAD AND UNDERGROUND LINES

12—43. What do member companies consider the maximum length of common secondary desirable? Is each case figured on a certain allowable voltage drop basis or is there an arbitrary limit as to length? What size wire is used for same and how is size determined? Are transformers operated in parallel, feeding different points on the same secondary?

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—Our secondary lines are approximately 500 feet, which we consider the maximum length desirable, and range in size from No. 2 to 4/0 wire. The length and size is figured on a voltage drop basis. The transformers are not operated in parallel, but each section of secondary feeds from transformer on the main bus.

The Toronto Electric Light Company, Limited, S. B. Hood, Superintendent Engineering Department, Toronto, Canada.—Arrangement of secondary is governed largely by local conditions. In no case, however, should voltage drop from transformer to farthest customer on the mains exceed 3 per cent. The practise of this company is to use a standard transformer, which in our case is 15 kilowatts, locating same at points of greatest density of load, such as large consumers, etc.

Where load is fairly well distributed over a considerable area we use No. 4 wire as a standard, spacing transformers in order to limit drop to 3 per cent. If this spacing will not permit of fully loading the transformers, larger sizes of wire are used and transformers spaced greater distances apart, these sizes being either No. 1 or No. 2/0 wires, 2/0 being the largest size used as a standard for our secondary distribution. All mains are run on the three-wire system, and where outer wires are larger than No. 4, the next standard size smaller is always used as a neutral. For instance, with No. 2/0 outers No. 1 neutral is used, with No. 1 outers No. 4 neutral, and if No. 4 outers all three wires of the same size. Secondary networks are interconnected at every possible point, and all transformers operated in parallel, fusing both the primary and secondary of the transformers, secondary, of course, not being fused on the neutral.

With this arrangement fully one-third can be saved in transformer capacity over single transformers operated on their own secondary section. These networks are not sectionalized in any way, dependence being placed on the combined capacity of the various transformers being able to burn off any ground or cross which may occur, which experience has proven they are capable of doing, our average interconnected network having a capacity of from 200 to 250 kilowatts. The operation of these large networks, however, requires that the neutral must be absolutely grounded, to obtain which our practise is

to ground the neutral service wire of every customer to a water pipe, connection being made in the customer's basement where service enters.

R. M. Stevenson, Brooklyn, N. Y.—Secondaries should not, as a rule, extend more than 600 feet from the transformer. Where trees or other obstacles would interfere with a primary line it might be desirable to stretch this limit a little. The voltage drop on lighting secondaries should not exceed five per cent, but on power secondaries, where an effort is being made to secure the benefits of the diversity factor of different customers, a drop of 10 per cent would be allowable.

The determination of the size of the wire should generally consist of the selection of one or two or three standard sizes. It is generally better to use a larger wire than the present load would require, so that more load could be added without rebuilding the secondary.

The operation of transformers in parallel is not to be recommended, because the investment in a number of small transformers, additional cutouts, crossarms, etc., is much greater than for one large transformer, and the efficiency as well as the appearance of this arrangement is much poorer. The localization of trouble is also more difficult.

When the load gets too heavy to be carried by the largest transformer in use, a separate secondary (feeding from another phase if on a polyphase system) should be built, in preference to banking transformers.

P. F. Williams, Assistant to General Inspector, Commonwealth Edison Company, Chicago, Ill.—The length of common secondary is determined by calculation in each case, allowing a two per cent voltage drop, and by the number of transformers installed. It has been found by carrying out a number of calculations, that when the secondary exceeds a No. 0 or 2/0 in size, it is more economical to shorten the length of the secondary and install transformers closer together.

Transformers are not operated in parallel excepting where the transformer capacity required exceeds 50 kilowatts. In such large installations transformers are banked.

12—44. Is it considered good practise to install a 50-kilowatt transformer on a single pole? Is it advisable to reinforce the base of a pole carrying heavy transformers with concrete?

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—There is no particular objection to installing a 50-kilowatt transformer on a single pole, but it is not considered good practise. I consider it inadvisable to reinforce the base of poles with concrete, as this makes the breaking point at the top of the concrete and does not allow the pole to pull over in the earth.

J. B. Crane, Commercial Engineer, Great Northern Power Company, Duluth, Minn.—We install our 50-kilowatt, 3-phase, 25-cycle transformers on a platform supported by two poles set about ten feet apart. This platform is about fifteen feet from the ground.

12—45. This company has been supplying 220-volt service from our lighting network to operate a 2½-kilowatt wireless telegraph outfit. Our system is overhead, 2200-volt primary, 110-220-volt secondary, transformers banked, neutral grounded. When the outfit was operated, considerable trouble was experienced on the consumer's premises in the immediate neighborhood, due to the breaking down of lamps, sockets, and insulating joints, and to meter stoppages.

Was this trouble caused by our overhead wires acting as receiver circuits, or was it due to a "kick-back" through the step-up transformer of the outfit, or to some other cause?

What can be done to remedy the trouble?

We would appreciate any information from companies supplying service to this class of business, regarding kind of service supplied, method of supplying same, trouble experienced, and methods of remedying same.

L. L. Elden, Boston, Mass.—The only solution of the trouble resulting from the operation of a 2½-kilowatt wireless telegraph equipment from a commer-

cial lighting circuit is to serve such a consumer with an individual service from an individual transformer. In addition to this precaution, the consumer should be required to install a condenser across the service wires immediately adjacent to and on the consumer's side of the meter. The condenser should have its middle point grounded and should be of sufficient capacity to absorb all charges which may be impressed upon it by the action of the wireless equipment. It is possible to operate 300 to 500 watt equipments from ordinary commercial secondary networks without difficulty or disturbances if a condenser of suitable capacity is installed and connected to the service wires in the manner indicated.

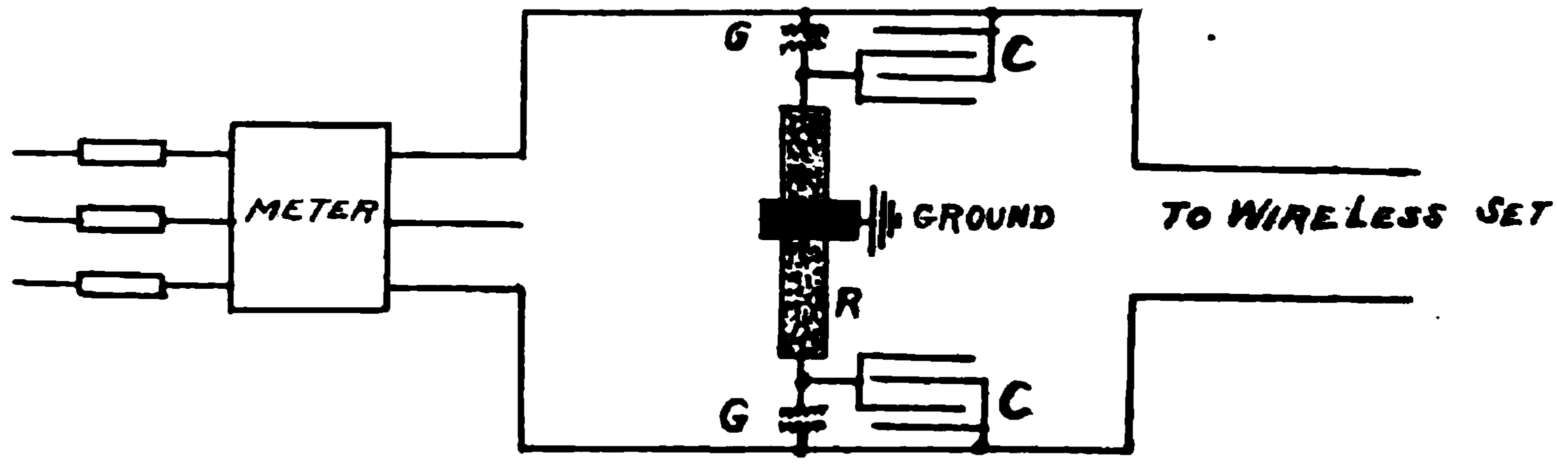
Commonwealth Edison Company, H. B. Gear, Engineer of Distribution, Chicago, Ill.—In two cases where service was given for long distance wireless telegraph outfits, that is, outfits designed to transmit up to 200 miles, much trouble was experienced from the burning out of meters and breaking down of lamps, sockets, etc. This trouble seems to be caused by the overhead wireless acting as receiver circuits and setting up high frequency discharges through the device connected to the 110-220 secondary mains. No adequate remedy was discovered for the trouble with these large outfits except where they were removed sufficiently from the largely built up sections, so that the disturbance was limited to their own equipment. Some relief might be secured from the use of 300-volt spark gaps placed between the outside wires and ground, but we have had no experience with such an arrangement. In our own case, the sending stations were fortunately discontinued after a few months' operation and we have not been required to study the matter further for devising ways of relief.

The Toronto Electric Light Company, Limited, S. B. Hood, Superintendent, Engineering Department, Toronto, Canada.—This company has quite a number of wireless telegraph equipments taking current from our secondary mains, and no particular trouble has been experienced from the inductive kick-back from these coils. Our secondary networks being solidly grounded to water pipes may be responsible for the absence of this trouble.

Our principal trouble with these outfits has been the disturbance of the voltage regulation due to the intermittent demands for current. This trouble has generally been overcome by shifting the nearest transformer on the network to a point as close as possible to where the wireless outfit is in use.

William V. Kohlbecker, Meter Department, Wilmington & Philadelphia Traction Company, Wilmington, Del.—This company supplied 110-volt service from our lighting bus line to operate a 4-kilowatt telegraph outfit. We experienced trouble on bus line until we placed the wireless outfit on a separate transformer, which was not grounded. This worked satisfactorily and we are now experiencing no trouble whatever on system.

R. M. Stevenson, Brooklyn, N. Y.—The trouble mentioned was due to the "kick-back" of the wireless set and may be remedied by the simple method shown in the following sketch.



The spark gaps "G" are to be set 1/64-inch apart. The condensers "C" shunting these gaps should be of about 1 or 2 M. F. capacity and well insulated. The only object of the graphite rod "R" is to prevent the holding of an arc on the spark gaps, or the blowing of the fuses in the event of the break-down of the condensers.

Daniel E. Rivers, West Madison Station, Commonwealth Edison Company, Chicago, Ill.—The best methods of eliminating disturbances are as follows:

The wireless station should receive its supply from a separate transformer. Connected close to the high potential transformer on each phase wire (the secondary side) should be an inductance coil; from the other end of the coil to a graphite resistance rod, then to a spark gap with the last terminal of the spark gap direct to ground. If the conditions are still too severe, a like set will be necessary on the secondary of the lighting circuit. The proper amount of inductance can be obtained by the use of small-size copper wire wound in a helical form. The resistance of the rod should be enough to limit the current when the discharge takes place in the spark gap. The length of the spark gap will depend upon conditions. This method will involve some experimental work to obtain the proper results and even then it cannot entirely eliminate trouble, but if properly installed will reduce it to a minimum and offer satisfactory service to lighting consumers in the neighborhood.

Burleigh Currier, The Philadelphia Electric Company, Philadelphia, Pa.—When energy is supplied to wireless telegraph outfits from alternating-current circuits, considerable trouble may be experienced on the consumer's premises and on other circuits connected to the same source of supply, due to the presence of high potentials. This generally causes the burning out of lamps and sockets, blowing of fuses, grounding of the service and house wires, "winking" of lamps connected to the same secondaries and the burning out of integrating watt-hour meters.

It is almost impossible to give any one method which can be applied in all cases to give the necessary protection to prevent damage to the apparatus and circuits.

The method which must be employed depends entirely upon the installation and therefore each case must be given individual consideration. In general, the possibility of high potential discharges increases with the size of the installation. However, in some cases wireless outfits of small capacity have given much more trouble than the larger outfits. The character of the installation is exceedingly important, the principal factors being the length of secondary circuit and size of wire; location and length of the aerial; relation of the aerial to the service and secondary wires; the possible screening effect due to the secondary or other wiring and metal work used in the construction of the building; the location of the meter in the secondary circuit; whether circuit, conduit or transformer is grounded; manner in which the wireless apparatus is operated, and the particular kind of wireless apparatus used and its general arrangement.

In small installations or where comparatively little trouble is anticipated, sufficient protection to the installation is afforded by the use of a non-inductive carbon or graphite resistance of about 20,000 ohms. This is connected across the line, a good contact is provided at the central point of the resistance, and connected directly to a good ground. This resistance is connected on the house wires, generally as near the meter as possible.

In other cases it is necessary to connect a similar resistance on both the service and house sides of the meter.

Where considerable trouble is experienced, in addition to the non-inductive resistance with the central points grounded, it is necessary to install a condenser which is connected directly across the line. Satisfactory condensers for this purpose have been made of 12 plates of crystal glass, 10 inches by 12 inches, each plate being covered with tin foil, about 8 inches by 10 inches on each side. Strip copper terminals should be provided and the plates connected in parallel.

In extreme cases, when it is very difficult to entirely eliminate the high potential, lightning arresters, well grounded, have been connected to each of the secondary wires in addition to the condensers and non-inductive resistances. However, in practically every case, we have been able to satisfactorily eliminate the high potential with carbon resistances and small condensers.

The service and secondary wires are acting as aerials or receiver circuits and the best results will be obtained when the installation is free from iron

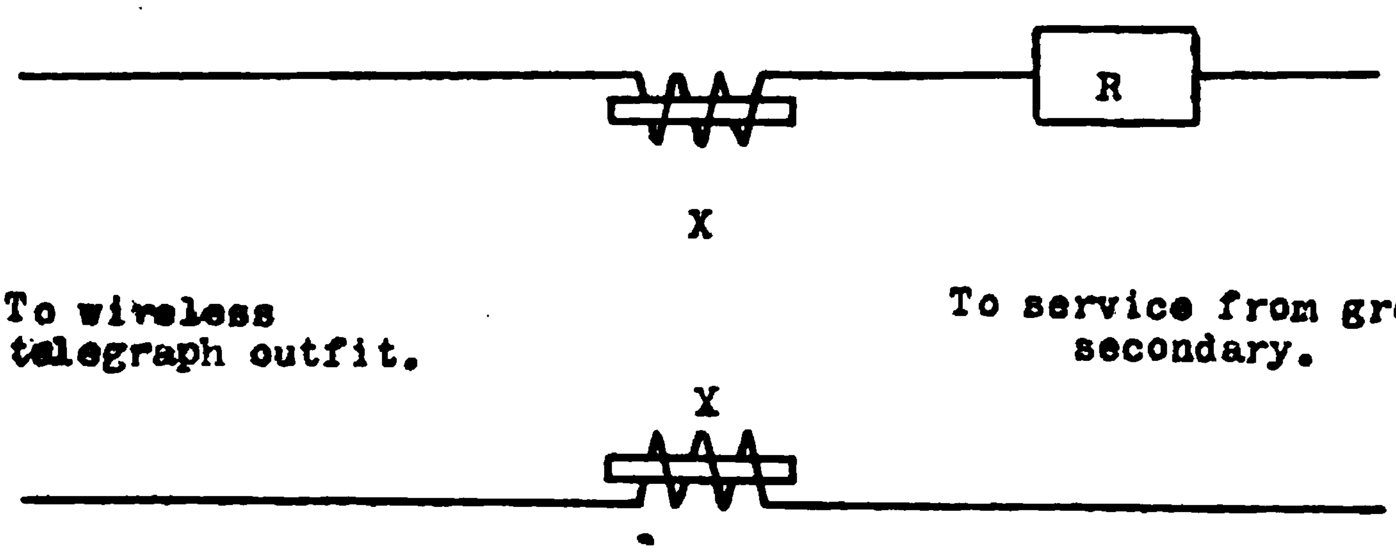
pipe or conduit. In a number of cases the trouble has been due to grounded conduits. It is better to have the secondary wires free from grounds.

In general the protecting apparatus should be connected to the circuit at the exact points where discharges are taking place. If connection is made to the circuit at a slightly different point, the results may not be the same.

Good results are obtained by using a separate transformer with a 220-volt secondary and an ungrounded neutral supplying only the wireless outfit.

The load is of an intermittent character and therefore very difficult to accurately meter. A high minimum should be required and some member companies may prefer to give a flat rate.

R. K. McMaster, Engineering Department, Kansas City Electric Light Company, Kansas City, Mo.—If a secondary circuit be subjected to a high potential high frequency disturbance from a wireless telegraph outfit breakdown of insu-



X. Reactance (low at lighting frequency).
R. Water Rheostat.

lation may take place even though the circuit be well grounded. The path from the ungrounded to the grounded wire, especially if only through meter shunts and transformer windings, may be insufficient to prevent potential rise on the ungrounded wire. This is due to the very high reactances corresponding to the very high frequency, say 300,000 cycles.

By the use of the accompanying circuit diagram the high potential trouble is eliminated and the voltage fluctuation so reduced that it is no greater than would be caused by a motor of equal current demand.

18—16. What capacity of subway transformers has it been found feasible to install in a single manhole?

S. B. Way, Chief Engineer, Electrical Department, Union Electric Light & Power Company, St. Louis, Mo.—The capacity in transformers which may be installed in a single manhole is limited mainly by the size cover opening which it is practicable to provide, as there is generally not room in a manhole to install more than one transformer. Where street conditions will permit, square or rectangular cover frames and covers may be used, though generally undesirable, and under such conditions single transformers up to 125 kilowatts may be installed.

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—This depends entirely on the size of the manhole, size of the mains and the installations to be served.

E. B. Meyer, Assistant Engineer, Public Service Electric Company, Newark, N. J.—In our underground system in the heavy districts the standard size of transformer used is 100 kilowatts. Two of these are frequently installed in the same manhole. The manufacturers of the transformer claim that in average cases eight watts of transformer losses may be allowed per square foot of wall surface; in moist soil with ventilated chamber 12 watts may be allowed, while under unfavorable conditions not more than six watts per square foot

would be permissible. The total surface includes roof and floor, and these should be included when determining wall surface.

S. J. Lisberger, Engineer Electric Distribution, Pacific Gas and Electric Company, San Francisco, Cal.—We have found it feasible to install transformers of capacity not to exceed 150 kilowatts in our manholes. If transformers of larger size are installed the matter of ventilation becomes a serious one; also the transformer is quite high, and in a great many cases sufficient head room cannot be obtained to get the transformers in the hole.

D. Boyle, General Foreman, Commonwealth Edison Company, Chicago, Ill. —A 15-kilowatt Western Electric and a 15-kilowatt General Electric transformer are the largest that can be used on our system.

18—17. Has it been found advisable for large subway transformer installations to provide artificial ventilation for the manhole? If so, how has this been accomplished?

S. B. Way, Chief Engineer, Electric Department, Union Electric Light & Power Company, St. Louis, Mo.—It is always difficult to provide satisfactory means for dissipating the heat given off from subway transformers. Ventilation has been provided in some instances by perforating the manhole covers, and the quantity of air circulated through the manhole may be increased by installing pipe connections between manhole and some convenient hollow trolley or arc lamp pole or by extending such pipes up alongside buildings.

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—All transformer manholes should be ventilated by drilling holes in the outer cover, also in the inner cover if one is used. Standpipe ventilators have been installed but have proved of very little value.

E. B. Meyer, Assistant Engineer, Public Service Electric Company, Newark, N. J.—We do not provide artificial ventilation for any manholes; all manholes are ventilated by means of a perforated cover, which is cast with 30-1 inch holes in it.

The Toronto Electric Light Company, Limited, S. B. Hood, Superintendent, Engineering Department, Toronto, Canada.—The only practical method of ventilating a manhole where used for subway transformers is to provide some form of a ventilating stack, together with an open cover manhole top. In ordinary construction, suitable ventilation may be obtained by means of the conduits or standpipes which are frequently brought down poles to supply these transformers, and in some cases a lateral conduit has been run to the nearest tubular trolley pole, the top of which is fitted with a suitable ventilating cap. Have tried induced ventilation with tight covers by bringing one conduit vent stack in near the bottom of the manhole, and taking the other out near the top, but find, however, that natural draft with this arrangement is not sufficient to give any material benefit.

S. J. Lisberger, Engineer Electric Distribution, Pacific Gas & Electric Company, San Francisco, Cal.—We have not found it necessary to provide for artificial ventilation.

18—18. Has it been found advisable to keep transformer vaults separate from the regular manhole?

S. B. Way, Chief Engineer, Electrical Department, Union Electric Light & Power Company, St. Louis, Mo.—With cables in manholes properly covered with a suitable fire resisting coating, there is not sufficient advantage to be gained by placing subway transformers in separate vaults to offset the heavy additional construction cost.

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—Small unit transformers can be installed in subway manholes, but where large units are required it is advisable to install them in separate manholes.

E. B. Meyer, Assistant Engineer, Public Service Electric Company, Newark, N. J.—Transformers are installed in street manholes with cables and other equipment, no separate vaults being provided. Manholes in which transformers

are to be installed are built sufficiently large to receive same. Subway type transformers are used, and in wet weather frequently operate entirely submerged.

S. J. Lisberger, Engineer Electric Distribution, Pacific Gas & Electric Company, San Francisco, Cal.—We place our transformers in our regular manholes. In a very few cases we have separate vaults, but these vaults are usually in the basements of large buildings and are constructed in accordance with the Underwriters' provisions, all entrance to the vault being from the outside of the building and the vault separated from the main part of the building by concrete or brick walls.

13—19. What are the relative advantages and disadvantages of one-piece built-in conduit and the regular clay duct? What is the comparative cost of material and labor, excluding the cost of digging and filling?

S. B. Way, Chief Engineer, Electrical Department, Union Electric Light & Power Company, St. Louis, Mo.—The advantages of one-piece built-in concrete conduit as compared with vitrified clay conduit are lower first cost, elimination of joints, offsets and sharp projections in the ducts, perfectly sealed ducts of a material best suited to resist the extremely high temperatures resulting from electric arcs, provision for obtaining perfect inspection of the ducts after formation, with consequent opportunity to correct defects before work is closed in, better alignment, drainage and greater strength. Its disadvantage is that its construction requires the street to remain open somewhat longer than vitrified clay or similar types of conduit. The cost of constructing one-piece built-in concrete conduit as compared with other types, making use of vitrified clay or other pipe surrounded by a jacket of concrete, may be determined approximately by subtracting from the cost of constructing such conduit the cost of the vitrified clay or other pipe delivered on the site of the work. The quantity of concrete will be approximately the same in either case, and the cost of handling, setting and fitting the pipe will offset the cost of handling moulds in the case of one-piece built-in conduit.

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—Single conduits laid in concrete are superior to multiple tile, on account of no open joints between the ducts, as very often when cable burns out in multiple tile the heat melts the lead armor off the cable in the adjoining duct.

The cost of multiple tile is approximately .048 cents per duct foot and of single tile .06 cents per duct foot, to which should be added about 10 per cent more for labor of installing.

13—20. In operating with reserve 13,000-volt cables, which is the better policy, to keep reserve cables alive on 13,000-bolt 'bus (thus subjecting them to possible damage as result of surges on system), or to keep them dead, and take chance on their failing when most needed?

L. L. Elden, Boston, Mass.—Assuming that reserve cable was maintained exclusively for reserve purposes for the supply of a single station, it would be the best policy to keep the cables dead ready for instant operation in the event of damage to the regular operating cables. If a single reserve cable be maintained for the insurance of the service of more than one station, it would be best to maintain the cable in service at all times.

Standard Underground Cable Company, H. W. Fisher, Chief Engineer, Perth Amboy, N. J.—I would not recommend the continued application of 13,000 volts on reserved cables. It would be much better to test the cables occasionally with 13,000 volts rather than to have them subjected to the possibilities of very high disruptive voltages due to the failure of cables or apparatus on the system.

Wallace S. Clark, Engineer, Wire & Cable Department, General Electric Company, Schenectady, N. Y.—It is not necessary to maintain operating pressure on the spare cable. It can be kept dead and tested periodically for insulation resistance, which would, if proper records were kept, undoubtedly give warning of any deterioration.

R. F. Schuchardt, Electrical Engineer, Commonwealth Edison Company, Chicago, Ill.—The reserve cables should under ordinary conditions be kept alive. If the cable insulation breaks down it is better to have the weak spots weeded out while the cable is in reserve rather than while in service.

E. B. Meyer, Assistant Engineer, Public Service Electric Company, Newark, N. J.—We believe it is better policy where reserve cables are installed to keep them alive, or, if operating conditions will permit, use the reserve cable part of the time, changing over at least twice a week. It this cannot be done, the reserve cable should be kept alive, not necessarily at operating voltage, but perhaps something under, so that if trouble develops it can be located and repaired, thus avoiding the possibility of the cable being unfit for service when it is most needed.

S. B. Hood, Superintendent Engineering Department, The Toronto Electric Light Company, Limited, Toronto, Canada.—The best method of operating 13,000-volt reserve cables is to keep them continually on the 'bus. This method has the advantage of keeping them under pressure at all times, showing that they are in condition for service when needed, prevents any chance of setting up a surge in the system due to the rush of current when throwing them on the 'bus, and further tends to proportionately reduce the drop in the group of cables, which would otherwise be greater with the reserve cables lying idle. In case of long lines this drop may save sufficient current, particularly where power is purchased from a transmission company, to more than pay the fixed charges on the cable.

P. B. Junke, Chief Load Dispatcher, Commonwealth Edison Company, Chicago, Ill.—Our own practise in this matter is based upon the opinion that it is better to keep reserve cables alive, permitting possible breakdowns to be discovered as they develop. Our experience indicates that breakdowns on live lines, due to surges set up by disturbances on any other part of the system, are comparatively rare; and as a large part of all our breakdowns are due to external causes, it seems better to keep reserve cables alive, in order to discover a fault the moment it develops.

Our only exception to this practise is found in the case of 12,000 and 20,000-volt loop-tie lines, where the tie line is depended upon as a reserve line for either one of the two sub-stations included in the loop. These tie lines are normally held dead, but are closed to the system once a day for test.

The underlying thought in this case, however, is one not so much of protection, but rather aims at having available, in case of breakdown of either of the two direct lines of the loop, a tie line known at least not to have caused the direct line to open automatically at the generating station. It is, therefore, immediately available to restore the service in the shortest time consistent with good operating.

18—21. Is there any chance of damaging good cable by repeated tests at 13,000 volts, no load?

L. L. Elden, Boston, Mass.—Cable suitable for operation as part of a 13,000-volt system should suffer no damage by the application of that voltage, if the cable was originally constructed to withstand a voltage test of two to two and one-half times the normal working pressure.

Standard Underground Cable Company, H. W. Fisher, Chief Engineer, Perth Amboy, N. J.—Making repeated tests at 13,000 volts on regular 13,000-volt cables, said cables not being loaded, should have no damaging effect on the cables unless at the time of the test an impulsive rise of voltage took place, due to short circuits or other causes.

Wallace S. Clark, Engineer, Wire & Cable Department, General Electric Company, Schenectady, N. Y.—I do not think there is any risk of damaging a good 13,000-volt cable by repeated applications of 13,000 volts at no load, although it would be advisable to arrange a small water rheostat or some other method for applying the potential gradually and cutting down the potential some time before the circuit is opened.

Habirshaw Wire Company, Fred J. Hall, Treasurer, Yonkers, N. Y.—This question is somewhat indefinite. It is like asking if a boat will cary 13,000

tons. It all depends on the size of the boat. Some will and some will not. In other words, to tell whether 13,000 volts will damage a cable, we would have to know the wall of insulation. As a general principle, however, excessive pressure tests do weaken the insulation, and the oftener these tests are repeated the more the insulation is weakened. A cable may stand a very severe test but at the same time be weakened so as to shorten its life. Our idea is that a cable should be tested for about two and a half times its maximum working pressure for five minutes, or 80 per cent of this for thirty minutes. This is not likely to weaken the insulation and proves that there is a sufficient factor of safety. It should not be frequently subjected to this test.

R. F. Schuchardt, Electrical Engineer, Commonwealth Edison Company, Chicago, Ill.—Not if the cable is built for 13,000-volt service.

E. B. Meyer, Assistant Engineer, Public Service Electric Company, Newark, N. J.—In our 13,200-volt underground transmission system, cables are cut in on the 'bus at operating voltages. This, no doubt, subjects the cables to at least double voltage every time they are put into service. Cables are 7/32-inch paper over each conductor and 7/32-inch paper jacket, with 1/8-inch lead.

G. W. Lunn, Chief Electrician, Commonwealth Edison Company, Chicago, Ill.—Yes, there is a "chance," but if the cable is in good condition, it should withstand the extra strain.

13—22. Is it good operation to put interrupted current on faulty cable, after insulation has been broken, for purpose of hunting trouble with telephone receiver and detector coil? If not, why?

L. L. Elden, Boston, Mass.—No harm can result from the application of low voltage interrupted current for testing purposes. This method of hunting trouble has been in use a number of years and will cause no trouble unless pressure and current values are employed sufficient to start a defective cable burning in a manhole, with possible attending troubles.

Standard Underground Cable Company, H. W. Fisher, Chief Engineer, Perth Amboy, N. J.—I have had no large experience relative to the use of interrupted current on faulty cables for the purpose of hunting trouble with telephone receiver and detector coils. I have understood that under good working conditions faults have been located very closely by this method. If the fault is a low resistance, one so that the voltage applied is low, then the use of an interrupted current of reasonable amount should not damage the cable.

Wallace S. Clark, Engineer, Wire & Cable Department, General Electric Company, Schenectady, N. Y.—There is no reason why the method of locating mentioned should not be used, but, of course, it is advisable to have the interrupted current of lower voltage than the normal operating current, and to obtain this from a circuit independent of the regular operating 'bus-bars in the station. It might be obtained from the exciter circuit, or by running one of the regular generators below normal speed.

Habirshaw Wire Company, Fred J. Hall, Treasurer, Yonkers, N. Y.—We do not see any reason why it is not a good operation to hunt trouble on a cable with interrupted current and a telephone. So far as our information goes, there is nothing against this method.

13—23. What would be the best method combining quality and cheapness of connecting temporary street illuminations from an underground system in which no poles at all are used, consumers' taps being taken from service boxes under the sidewalk? Cables, lead covered, run in tile conduits. There are iron poles for trolley wire construction.

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company, Brooklyn.—Assuming that this temporary lighting is strung from the trolley poles, I would advise running standpipes up the outside of the trolley poles from the distributing boxes. If the boxes are not near enough to the poles for this plan, temporary taps could be taken from the main cables by breaking the duct and making temporary connections.

F. J. P. Senel, Street Department, Commonwealth Edison Company, Chicago, Ill.—If a temporary connection is wanted for light stringers across the street, the best method of connecting would be to install duplex rubber-covered wire in one-half inch or three-quarter inch pipe, from the service box under the sidewalk to building, and up on the outside of the building, to a point just above the first story, and from this point, open wire.

For lamp posts, install duplex rubber-covered wire in one-half inch pipe, under the sidewalk, and extend same through the sidewalk to the post. If the sidewalk is not excavated, install duplex lead-covered wire in three-quarter inch pipe between curb and sidewalk to lamp post.

TRANSFORMERS, STORAGE BATTERIES, ETC.

14—7. Have any member companies had any experience with the Edison Battery for vehicle work? Would certainly appreciate any information we can get on this subject.

William H. Meadowcroft, Laboratory of Thomas A. Edison, Orange, N. J.—ACTUAL FIGURES OF A COMPARATIVE TEST OF GASOLINE AND ELECTRIC TRUCKS, each of one-ton capacity.

The electric was operated with Edison Storage Battery.

JANUARY, 1911.

	Gasoline Truck	Electric Truck
Gasoline at 10 cents per gallon	$10.50	
Oil at 24½ cents per gallon	.74	
Electricity at 1 cent per K. W.	.06	$3.36
Distilled water at 7½ cents per gallon		.38
Repair parts, etc.	.50	
Time on special repairs	.45	.60
Total Expense	$12.25	$4.34
Total Mileage (26 days)	458	470
Average daily mileage	17.6	18
Average cost per day	.471	.167
Average cost per mile	.027	.009
Average cost per mile for gasoline and oil	.025	
Average cost per mile for electricity and distilled water		.008

FEBRUARY, 1911.

	Gasoline Truck	Electric Truck
Gasoline at 10 cents per gallon	$11.00	
Oil at 24½ cents per gallon	.49	
Electricity at 1 cent per K. W.	.08	$7.86
Distilled water at 7½ cents per gallon		.53
Repair parts, etc.	.55	3.40
Time on special repairs	.60	
	$12.72	$11.79
Total mileage (28 days)	503	1035
Average daily mileage	18	37
Average cost per day	.45	.42
Average cost per mile	.025	.011
Average cost per mile for gasoline and oil	.023	
Average cost per mile for electricity and distilled water		.008

Five other gasoline trucks of different makes also took part in this competitive test, but they were only of half-ton capacity, and the expense of operating them was so exceedingly high in comparison with the above figures that it is deemed unnecessary to give the details.

Eugene Creed, Toronto, Canada.—Our greatest difficulty with the Edison battery which we installed in two trucks that were loaned us occurred when the vehicles were negotiating grades, when the voltage dropped. We also had some difficulty during extreme cold weather, though the trouble may have been due to ignorance on the garage workman's part.

T. H. Yawger, Superintendent, Electric Department, Rochester Railway & Light Company, Rochester, N. Y.—The writer has been using an electric vehicle equipped with an Edison battery consisting of 64 cells, type A-4, 150 ampere hours capacity, for the past twelve months.

In that time the total mileage covered was 7700 miles. The largest mileage obtained on one charge was 76 miles. At the end of the 7700 total mileage, the reduced capacity of the battery necessitated the renewal of the solution.

With this exception, there have been absolutely no repairs or attention paid to this battery other than to take care of evaporation. In fact this battery has had no particular attention other than what the average user of a battery would give it.

The battery has very many times been completely discharged and left in that condition for several hours; and has been excessively overcharged without any apparently bad effects.

One criticism which we have to make regarding this battery is its operation during the colder months of the year. If the vehicle is left standing in a temperature of below 32 degrees for two or three hours, it practically loses its charge. Under the same temperature conditions, if the vehicle is kept in service, approximately 60 per cent of battery capacity is obtained.

15—52. I would like the opinion of power transmission companies who have high-voltage, air-cooled transformers and regulators, as to the best method of removing accumulated dust, and how often it is done?

(Also answered in March BULLETIN.)

British Columbia Electric Company Section, National Electric Light Association, Vancouver, B. C.—Use compressed air, 40 pounds to square inch. Clean at least once a week, or oftener if surrounded by dust and dirt.

15—54. What kind of primary fuse is best to use on potential transformers? Should the secondary be fused, and, if so, is it necessary to have the fuse at the transformer?

(Other Replies in March BULLETIN.)

C. J. Hejda, Testing Department, Commonwealth Edison Company, Chicago, Ill.—From numerous tests made on various types of potential fuses, I have found the S. & C. extra high potential fuse best suited for potential transformer primary. Potential transformer load is a predetermined constant instrument load, and, therefore, there is no danger from overload. The danger of short circuits on pressure wiring is also very remote in a first-class installation, and therefore, ordinarily the secondary of a potential transformer is not fused.

Connecticut River Transmission Company, E. J. Richards, General Superintendent, Fitchburg, Mass.—We have primary fuses on practically all potential transformers, using General Electric Catalogue No. 43308 fuse blocks, with catalogue No. 21452 fuse for 2200-volt transformers. With 6600 and 13,000-volt potential transformers, we generally use type of transformer which has fuse mounted on the top of the case on rubber supports (similar to their catalogue No. 27615). With Westinghouse potential transformers we use their standard fuse, similar to their catalogue No. 55383. In many cases we use fuses on the secondaries of these transformers, using General Electric fuse block, catalogue No. 42412, with catalogue No. 32579 glass type fuse. They should by all means be placed at the transformer or as near thereto as possible.

British Columbia Electric Company Section, National Electric Light Association, Vancouver, B. C.—Use enclosed cartridge fuses on primary; not necessary to fuse secondary.

LAMPS AND ILLUMINATING ENGINEERING

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40- and 80-watt tungsten series lamp.

H. H. Magdsick, Engineering Department, National Electric Lamp Association, Cleveland, Ohio.—Incandescent gas street lamps of the usual type are rated at 60 horizontal candle-power. In a laboratory test the mantles will show an initial intensity equal to or even greater than the rating, but in service the candle-power varies with the maintenance of the burner and age of the mantle and is reduced by the absorption of the globe and by variations in the quality of gas, gas pressure and atmospheric conditions. The average performance is indicated by the following tests:—

In the *Electrical World* for November 10, 1910, page 1110, is given a report of an investigation of street lighting in Chicago by the Merriam Commission. "As the result of individual inspection of 956 gas-mantle lamps, it was found that 60.9 per cent could be described as good or fair. . . . Photometric field tests of the mantle lamps which could be classed as 'passable' (good or fair) showed a range of candle-power from 10.6 to 41.6, the average being 25.8."

In the *Electrical World* for September 2, 1909, page 538, is reported a "Test of Welsbach street lamps, 60 candle-power size, made under the personal direction of Dr. Louis Bell. . . . These lamps (17) were taken just as they came without any selection. The candle-power ranged from 16.6 to 66.3; the average was 31.7."

Mr. P. D. Wagoner reports, Volume 1, Proceedings 1908 Convention National Electric Light Association, page 457, "Tests have recently been made in three New England cities on the gas-mantle street lamp while operating under actual service conditions, and the following figures indicate the wide variation in candle-power of this type of lamp in actual service:

City	Maximum C-p.	Minimum C-p.	Average C-p.
1	55.0	21.5	36.7
2	25.0	6.5	16.8
3	55.1	16.3	27.8

J. R. Cravath, Consulting Engineer and Special Contributor, *Electrical World*, Chicago.—Tests conducted by the writer in 1910 on gasoline street lamps in the city of Chicago for the Merriam Commission on city expenditures, showed that the candle-power of these lamps in actual service at the time varied between 14 and 58 candle-power. The average of 12 lamps tested in the presence of the gasoline lighting company's expert was 26.3 horizontal candle-power. Other tests made unofficially confirmed these results. Tests on gas mantle burners made about the same time showed still less favorably because of the variations in gas pressure, which made adjustment for a maximum candle-power difficult. For further information regarding these tests see *Electrical World* of August 18, 1910, page 368. Since these tests were made changes have been made in the gasoline street lighting contract and it is the writer's impression that higher average candle-powers are now obtained, but he has made no tests to verify this impression.

16—40. We have, during the last two months, been trying out the "Pemco" tungsten arc lamp equipped with 250-watt, 6.6 ampere series Mazda lamps and roughed inside globes, in comparison with 6.6 ampere series inclosed arc lamp with opal inner globes, for street lighting in our city. We would like to hear the opinions of other central stations, if there are any that have tried these lamps, as to the comparative efficiency of the two lamps for street lighting service.

The Indiana Electric Transmission Company, Jacksonville, Indiana.—We are substituting 250-watt clear globe 6.6 ampere series tungsten lamp for A. B. and Western Electric Arcs, using clear inner globes. The citizens consider it an improvement at the same price per lamp. Have this come as a request from the city.

16—41. What experience, if any, have member companies had in the use and installing of the 400 and 500 watt Mazda units, as to life and methods of installing?

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—500-watt Mazda units are frequently installed for outside lighting. The life of the lamp is very satisfactory. In installing these lamps a special socket is required and it is customary to allow them to be installed upon the present lighting system, provided same is not overloaded.

Lloyd Garrison, Utah Light & Railway Company, Ogden, Utah.—Our first installation of 500-watt tungstens, six G. E. monolux units, is still in operation and giving first-class service. These lamps were installed in a clothing store which closes at 6.00 p. m. every evening except Saturday, and the installation was made six months ago. We have also installed many with Holophanes.

17—30. This company has been trying to get a company prominent in the development of lighting fixtures to furnish fixture for inverted lighting with a reflector and outer casing of glass, the outer casing being dense enough and so tinted as to bring the light value to about that of the ceiling above, thereby avoiding the dark underbody of the fixtures now generally used for this work, with the sharp contrasts involved.

A fixture of the above description would be especially suited to rooms where fixture itself is often in the line of vision, such as bed-rooms, hospital wards, etc.

Would there not be a considerable demand for such a fixture?

Holophane Company, V. R. Lansingh, General Manager, New York.—The Holophane Company has been experimenting for a long while on the question of what may be termed a semi-indirect lighting fixture in which a certain percentage of the light is allowed to pass through the inside reflector and the outer glass casing, while the majority of the light is reflected directly to the ceiling. There are several important physiological factors in this problem which have not up to the present time been definitely decided. One of these is the ratio of the direct to the indirect light, and another the effect of this and also indirect lighting on the eyes, not simply from casual use, but from actual, definite physiological and psychological tests.

We trust to be able to place on the market in the near future something which will be acceptable from the psychological as well as the physical standpoint.

As regards the use of indirect lighting systems for bedrooms, hospital wards, etc., I would state that I believe this is very poor illuminating engineering practise, as a person lying on his back should not be compelled to gaze at a brilliantly lighted ceiling.

J. R. Cravath, Consulting Engineer and Special Contributor, *Electrical World*, Chicago.—It is the writer's observation that fixtures of the class described are in considerable demand and that this demand has been but little met up to the present time. While the majority of people do not object to the opaque inverted or indirect lighting fixture, there are some who do, and there is no valid reason why this objection cannot be done away with. In fact, certain fixture manufacturers are already taking steps to do this and can supply such fixtures. It has already been done in a number of cases, and in the writer's opinion such fixtures are destined to become very popular in the future, since they combine artistic decorative lighting effect with comfortable and pleasing illumination.

17—31. Will some member please advise a practical electrician, with a fair electrical engineering education and six years' experience, as to the best procedure of study to qualify as an illuminating engineer? Give also the essential requirements as to what an illuminating engineer should know.

Louis Bell, Ph. D., Boston, Mass.—About the only way to learn illuminating engineering at the present time is to study the literature of the subject as it has developed in the last four or five years. There are no proper courses of instruction on the subject as yet available, save to students in a very few places, and the courses given are mostly advanced photometry rather than illuminating engineering. "The Transactions of the Illuminating Engineering

Society," together with the Baltimore lectures on "Illuminating Engineering," which may be obtained from Johns-Hopkins University, form by far the best text-book of the art as yet available. It would be difficult in brief compass to give the requirements as to what an illuminating engineer should know. The books just referred to will convey to the reader a vivid idea of the range of things that must be covered by one who attempts to familiarize himself with present knowledge of the subject. For the present generation of engineers who have already had their technical education, there is nothing for it yet but private study, which can be made extremely effective.

J. R. Cravath, Chicago, Ill.—The requirements and qualifications of an illuminating engineer have naturally been rather indefinite because this special branch of engineering is so new. For a more complete outline of the subjects which should be familiar to a thoroughly trained illuminating engineer, the questioner is referred to the lectures at Johns-Hopkins University, Baltimore, conducted under the auspices of the Illuminating Engineering Society last year. These lectures can be obtained by application to the university.

Assuming that the questioner has had some technical training, so that he knows how to think and analyze subjects in an engineering way, a study of all the available literature combined with a practical experience in planning lighting installations, either with some concern manufacturing lighting appliances, or with a central station company or contractor, is suggested. He should, of course, join the Illuminating Engineering Society.

As a brief outline of the subjects with which the illuminating engineer should be familiar, I would suggest: 1, knowledge of lamps and methods of producing light, as well as the physical principles of light itself; 2, knowledge of the auxiliary appliances used in connection with lamps to accomplish various desired results; 3, knowledge of the effect of light on the eye, both physiological and psychological; 4, a knowledge and appreciation of the artistic requirements in different classes of work.

E. L. Elliott, Editor *The Illuminating Engineer*.—I have been asked this question so frequently that I will avail myself of the opportunity to answer it as fully as possible.

The propounder of the question in this case may be safely assumed to possess a knowledge of algebra sufficient to make him familiar with simple equations, and of plane geometry, elementary plane trigonometry, and the elements of chemistry and physics. Those whose education is lacking in any of these respects should perfect themselves in the subjects mentioned either by home study, with or without the assistance of an instructor, or by correspondence, or in regular classes. With this foundation the student should next take up a further study of the theory of light and photometry. Any of the elementary college text-books will serve as a basis for the study of light. Stein's "Photometric Measurements" is an excellent book for those who do not care to deal with the higher mathematics of the subject. Wickenden's "Illumination and Photometry" is a more recent work, and contains a considerable amount of valuable matter aside from the science of photometry.

Practical familiarity with photometers and illuminometers is absolutely essential. To depend upon book knowledge of this subject is like learning to swim without going into the water. The use of the various photometric instruments, however, is very easily mastered, and the student may well afford the time necessary at the laboratory of some college or technical school requisite for such work. Dr. Steinmetz's "Radiation, Light and Illumination," is an invaluable work, and may serve as a basis for the physiological side of illuminating engineering. While it makes use of higher mathematics, the subject is so clearly stated that these portions can be omitted if necessary without interfering with the balance of the subject.

The Johns-Hopkins University lectures, which will soon be available in book form, form a sort of encyclopedia of illuminating engineering at the present time, and should by all means be included in the student's library.

Various bulletins issued by the General Electric Company, the National Electric Lamp Association, the Westinghouse Lamp Company, The Cooper Hewitt Electric Company, the Nernst Lamp Company, the Welsbach Company, the Holophane Glass Company, and some of the other manufacturers of reflec-

tors and glassware, contain a great deal of very valuable matter, and will be gladly supplied gratis by the several companies.

The Illuminating Engineer, New York, contains articles dealing with various subjects in both a technical and popular manner, and a complete bibliography of all current literature on the subject. *The Illuminating Engineer*, London, is the official organ of the British Illuminating Engineering Society, and contains all of its proceedings, besides special contributions and other articles. Most of the matter which it publishes is of a strictly scientific engineering character. Both of these magazines are published monthly.

The Proceedings of the Illuminating Engineering Society, New York, contain papers on every phase of the subject, most of which are not so highly technical as to be beyond the average student.

The student should possess and make himself thoroughly familiar with the use of the Macbeth Calculator. This is the illuminating engineer's slide rule, and when once its use is thoroughly understood, which requires a little practise, calculations can be made with practically no liability to error and in a fraction of the time required by the ordinary mathematical calculations.

Having acquired a fair degree of mastery of the engineering side of the problem, the student should familiarize himself with at least the elements of the artistic and aesthetic phases of the subject. Some good general reading on the principles of architecture and decoration should be done, supplemented by careful observation and analysis of the various types and principles as exhibited in existing buildings. Ruskin's "Seven Lamps of Architecture," is a delightful and helpful book, but the reader must remember that it presents one man's ideas, and consequently, like the works of any other single author, must not be swallowed whole. Any public library will contain books on this subject.

Clifford's "Decorative Periods" is a recent work, and well worth possessing.

Coincidently with the study of the various subjects outlined, the student should make careful observations of lighting installations of all descriptions, endeavoring to discover defects, and asking himself the question, "How would I have done this if it had been put up to me?" It is notoriously easier to tell what is bad than to tell how to do it better; and the illuminating engineer is not primarily a critic, but an originator; his work is constructive, not destructive.

Finally, the student should connect himself as soon as possible with some individual or concern that is actively engaged in some part of the general field of illumination, so that he can obtain actual practical experience. In order to avoid becoming prejudiced and narrow, however, it will be well for him to change positions from time to time in the earlier part of his career, in order to get different views of the subject.

Though the profession is still new it is already large enough to make specialization advisable, and the student should direct his energies into some particular channel as soon as he discovers his special fitness and interest. Thus, he may look toward the commercial side of engineering, the manufacturing side, the artistic side, or restrict his studies into even narrow channels. A general breadth of knowledge and experience, however, is the only safe basis for specialization.

As to the essential things that an illuminating engineer should know, the following list is perhaps reasonably near the truth:

The theory of light and optics, so far as it can be acquired without the use of the calculus; an intelligent comprehension of the physiology of vision; such a familiarity with the various light-sources and units as will enable him to give an accurate comparison of efficiency in regard to their production of light, efficiency as light producers, relative initial costs, physical advantages and disadvantages, and their relative cost of maintenance and operation; a knowledge of the general principles of architecture, and of the characteristic features of the principal periods or schools of decorative art; the ability to make all the necessary engineering calculations readily and accurately, and, as an absolute essential overcapping all others, a natural taste for engineering, coupled with that innate ability to pass sound judgment which is generally called common sense.

H. J. Colman, Jr., Illuminating Engineer, Kansas City Electric Light Company, Kansas City, Mo.—Illuminating engineering covers a very wide and diversified field. Therefore, to attain success in this profession, it becomes necessary to give the following topics careful consideration and study:

First: Formulae and methods of determining the location, kind and quality of light for obtaining desired results.

Second: Illuminants of all kinds from the time they enter the factory as raw material until they leave, a finished product.

Third: Reflectors, diffusers and shades.

Fourth: Color values, and their relative effect upon light-giving sources caused by absorption and reflection.

Fifth: Harmony, color, and the basic principles of design.

Sixth: Period or epoch architecture.

Seventh: Photometry and the use of photometric instruments.

Eighth: Advantage should also be taken of the articles covering illumination, published in the current electric literature.

To cope successfully with the various problems that confront an engineer in actual practise requires individuality, governed by not only the basic principles of the art, but also by conditions surrounding each case.

17—88. When member companies replace or have replaced outside Nernst lamps in front of customers' premises with tungsten lamps, what sort of fixture unit is used?

William V. Kohlbecker, Meter Department, Wilmington & Philadelphia Traction Company, Wilmington, Del.—This company is replacing to some extent Nernst lamps, using the Nernst accessories as a tungsten fixture by removing the inside of lamps and installing socket in case and using either the bell or dome shades. If it is required to place ball over shade, a collar is necessary to give proper opening.

P. J. Smith, Superintendent Arc Lamp Department, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company uses the four-light, number 778 Federal Electric Outdoor tungsten cluster.

28—1. Have any member companies had any experience in installing a street lighting system, composed of combination lighting and tramway poles, using multiple tungsten lamps? We particularly desire to know whether an increase in cost of maintenance is found, resulting from vibration of poles, etc.

C. G. M. Thomas, Vice-President, New York & Queens Electric Light & Power Company, Long Island City.—Our tungsten street lights with the exception of those in the parks are entirely of series lighting of 75-81 watts and are connected on the same circuits with our arcs. We have none on railway poles but have made experiments in this direction and found that there was no increase in the cost of maintenance, and, as a result of these experiments, concluded to put up about 100 of them on poles of a trolley company; that we did not do so, however, was due entirely to our inability to close a satisfactory arrangement with the trolley company. We believe that there is no serious objection in the matter of maintenance resulting from the vibration of these poles, though, of course, we do know that many tungsten lamps are broken by the base of our ordinary lighting poles being jarred.

Geo. H. Harries, Vice-President, Potomac Electric Power Company, Washington, D. C.—We are using some series 5.5 ampere tungsten lamps on trolley poles and do not find that the maintenance of these is any more than on ordinary poles. The only multiple lamps we have on trolley poles are a small number at a bridge approach. These are 100-watt, 117-volt, Gem lamps, with a line voltage of approximately 110. We find the maintenance on these gem lamps is greater than on lighting poles, the difference being due to vibration; because of the vibration we find it inadvisable to use tungsten lamps.

Poughkeepsie Light, Heat & Power Company, Arthur S. Ives, Assistant General Manager, Poughkeepsie, N. Y.—In September last, the lighting system on two blocks of our main business street was changed by substituting combination trolley and lighting poles for the independent system previously

installed. In the new system, four 100-watt tungsten lamps are installed on each pole. There are now 31 of these poles so equipped. These lamps have not been installed long enough to give any very accurate results as to maintenance and life of lamps, but up to the present time we have been unable to discover that the ordinary vibration of the trolley wires has had any effect on the normal breakage of the lamps. In two instances, however, damage has been done by the trolley pole of a car leaving the wire and striking against the span wire. This can, we think, be remedied by the use of some one of the automatic devices for drawing down a pole which has left the trolley wire.

ELECTRIC POWER—MOTORS

19—47. What has been the experience of companies with the use of refrigeration plants in apartment houses? In groceries? In saloons?

(See March Bulletin for other Answers.)

E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—Almost all the central station companies in large cities have considerable business with groceries, butcher shops, saloons, etc., for furnishing power for driving some refrigerating machinery. Where the power rates are five cents per kilowatt hour or less, the service is economical to the consumer as against the retail price of ice in most large cities. There are a number of manufacturers putting out small refrigerating machines of from one-half ton to two ton capacity that are reliable in their action. These machines do not have to be automatic, although there are some machines of this class on the market. If particular cases are desired, almost any one of the large central station companies can give concrete examples of cost of the service if the conditions are stated.

British Columbia Electric Company Section, National Electric Light Association, Vancouver, B. C.—We have successfully operated 12 in hotels, restaurants and butcher shops; none as yet in apartment houses or in groceries.

19—49. Would appreciate any information obtainable on the electric drive for rock-crushing plants, particularly as to the current consumption per cubic yard, and the average load factor for this class of work?

W. H. Mason, The Edison Portland Cement Company, Stewartsville, N. J.—It is almost impossible to give anything like an average load factor or current consumption in stone-crushing plants, as it depends so much on the type of crusher used and the size and quality of the stone sent to the crusher. It would be very difficult to give an estimate on account of the great variation.

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—Have the following installations and append bills for four months in each case. A crusher, screens and an elevator are operating:—

100 horse-power polyphase motor, crushing stone.

K. W. H.	Amount
3390	$101.70
5020	150.60
5640	169.20
5340	160.20

50 horse-power polyphase motor, crushing stone.

K. W. H	Amount
2840	$102.25
1910	68.75
1750	63.00
2550	91.80

Charles Robbins, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—We send herewith data accumulated on the subject of Rock and Stone Crushing. These readings were taken from actual installations operated from central station service.

Our general observation has been that this work is more or less of an intermittent nature, and on account of its intermittency the kilowatt hours per ton of rock or stone crushed will vary considerably. However, we are pleased to send you the information that we have, and you can use it for what it may be worth.

(The accompanying data is valuable, but too voluminous for publication in limited space available in *Question Box*. Copies will be supplied by Editor of *Question Box* upon request.—Ed.)

J. B. Crane, Commercial Engineer, Great Northern Power Company, Duluth, Minn.—Last August we connected to our lines a rock-crusher plant. This plant is running crushers with an 85 horse-power, 3-phase motor and is operating an 800 cubic foot air compressor with a 150 horse-power motor. The air compressor is at the present time only delivering 400 cubic second feet and we reduced the speed of the air compressor by putting a small pulley on the motor in order to bring down the peak on this customer's load. We also have a 3 horse-power induction motor driving a centrifugal pump for circulating water to the air compressor and for pumping water to a crane in the quarry.

The consumption for months has been as follows:

Month	K. W. H.
August	40,440
September	34,920
October	32,760
November	32,760
December	13,680

The maximum five-minute peak on this load is 163 kilowatts. This plant shuts down about the middle of December and does not operate during January, February and March.

The average load factor during the months this plant was in operation for the whole month is 30 per cent.

We have not, at the present time, any figures as to the current consumption per cubic yard of rock, but where the plant is using an air compressor for furnishing compressed air, I should imagine that this amount would vary widely.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—We have in Columbus one rock crushing plant, which uses 20 horse-power motor with an average yearly load factor of 10 per cent. We are unable to obtain enough information to give the number of kilowatt hours per cubic yard of stone crushed.

Edward Curry, General Contract Agent, Economy Light & Power Company, Joliet, Ill.—We have a number of stone quarries from 50 horse-power to 2600 horse-power, running practically continuously during the year 1910. Following is the kilowatt-hour consumption and the cubic yards of stone handled.

Connected Load	Kilowatt-Hour Consumption	Cubic Yards of Stone Handled
50 horse power	23,230	
65 " "	7,370	
345 " "	123,516	96,000
355 " "	276,310	201,259

The 2600 horse-power installation figures are unobtainable, as to amount of stone handled, and at their request, we are unable to make public the amount of kilowatt hours used per year.

19—50. Have member companies been successful in securing power contracts for the complete operation of (a) breweries, (b) laundries?
If so, under what conditions were the contracts secured?

H. W. Peck, Assistant Electrical Engineer, Rochester Railway & Light Company, Rochester, N. Y.—(a) We have had a power contract with one of the largest breweries in Rochester for about three years for all power except the refrigerating machines. We replaced with individual motor drive two steam engines, each driving several hundred feet of shafting, with heavy belts

and many steam pumps. The engines were operating approximately 24 hours a day with a very low load factor. We obtain with electric drive an annual load factor of about 13.6 per cent. The exhaust steam from the refrigerating machines supplies all heat required for hot water and other low-pressure heating. We are working with another of the breweries, with whom we hope to close a power contract.

(b) We have had for about three years a power contract with a "wet wash" laundry, having replaced a steam engine and effected a very material saving to the customer. We have been unable to secure contract from any of the complete laundries in the city.

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—Nearly all of the smaller laundries are operating with electric drive, current for the motors being supplied by the central station. About one-half of the number use electric irons and the remaining use gas-heated irons. Steam is only used and provided from a small boiler for the heating of the water necessary for washing. In many cases economy in operating cost has not secured this business, but the convenience, the freedom from labor troubles and the reliability of the central station service, has.

We are not at this time operating breweries completely with central station service. Two of the breweries are more than one-half equipped with motors operating on our lines, and at least 30 per cent of the work is being performed in the remaining breweries by motors operating upon our lines, and from the progress made thus far we expect to secure all of their business in the near future.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—In Columbus we have two laundries, but in one laundry only have we a complete electrical installation. Both laundries are using electric irons exclusively. This we find to be a good entering wedge for more power. Service is supplied to the laundries at regular rates.

John Meyer, The Philadelphia Electric Company, Philadelphia, Pa.—We have not been successful in securing power contracts for the complete operation of breweries and laundries. In both classes of business, we have secured contracts for a portion of the installation for emergency service, and for the service required at night. We have several laundries connected to the system, one of which uses our current exclusively for light, heat and power. This laundry equipment is operated successfully and we believe economically. The current is sold under our standard contract.

29—1. In heavy electric trucks, which seems best practise, one or two motors? What are the advantages and disadvantages of two motors over one, with differential?

Cecil P. Poole, Editor of *Power*, New York.—Competent and experienced engineers differ violently on the first question. To an impartial observer the case presents itself about as follows:—two motors are heavier and more expensive and less efficient while running at or near rated speed than one motor and a differential gear. The single motor, however, unless it be built with two armature windings and commutators, takes twice the starting current required by two motors and twice the running current at half speed. These two points are important when the source of current is a storage battery, as in the cases under discussion. If the single motor be built with two armature windings and commutators, it still would be open to the objection that trouble in one winding is likely to damage the other one, which is not true of two separate motors. However, if one winding should be disabled without affecting the other one, the differential gear would transmit the power of the good winding to both rear wheels, giving maximum traction, whereas only one of the traction wheels would receive power from the two-motor equipment if one motor should be disabled. This is really a minor point, however, because a truck could not be operated under half power unless it were empty or carried an insignificant load.

Personally, I should prefer to use two motors with series-parallel control, but the abstract question seems to boil down to the classic offer: "Ye pays yer money and takes yer choice."

G. Herbert Condict, New York.—Manufacturers have been inclined to adopt the single motor drive with differential for electric trucks, at least up to three-ton capacity. The introduction of modern steel, having great hardness as well as toughness, has practically eliminated the differential gear as a trouble producer, so that its use is not at all a disadvantage. The fact that there is only one machine to look after instead of two in the single drive, is also an advantage. The power consumption of the two equipments is practically the same, although somewhat in favor of the single motor. The double-motor equipment has somewhat the advantage on slippery pavements, as when motors are run in parallel the tractive effort is more evenly divided between the two driving wheels. There is also a slightly decreased chance of a pull-in with two motors, as, if the load is not too heavy or the roads too bad, one motor will move a vehicle.

This advantage is somewhat counterbalanced by the increased chance for trouble in having two motors instead of one to get out of order.

Taking all these facts under consideration, the preponderance of opinion appears to be that the single-motor drive is preferable to the double-motor drive.

Louis Ruprecht, President's Office, General Vehicle Company, Long Island City.—We have found that the single-motor drive is at least 25 per cent more efficient in current draft than the two-motor drive under average conditions. It also costs less to build and maintain, is more accessible for inspection and repair, and seems to meet all the requirements of service. We find that the differential necessary with the single motor involves no greater objection than the use of two motors in place of one.

E. R. Whitney, Chief Engineer, Commercial Truck Company of America, Philadelphia, Pa.—We are sending you enclosed copies of our *Bulletins Nos. 3 and 4*, describing the construction of our two-ton two-motor-driven truck, and bulletin on three and one-half and five-ton four-motor four-wheel-drive trucks. We also use single-motor drive for lighter vehicles, but believe the dividing line between one and two motors should be made on trucks having carrying capacities of about two tons. The bulletins which we are sending you advance a number of arguments in favor of the two-motor and four-motor-drives for heavy trucks.

The Lansden Company, John M. Lansden, Jr., Newark, N. J.—In reference to the use on heavy electric trucks of a single motor with a differential as against two or perhaps more motors, we would say that the single outfit, on account of its simplicity, lighter weight, and higher efficiency, would be commercially preferable. Under any road condition the energy consumed is readily measured and we do not believe that the practicability of a two wheel-drive could be questioned. That is to say, with any two wheel-driving truck less weight, fewer parts, less space, and higher efficiency are involved. Again, it is easier to maintain, quiet running and reduces the care and chances with controllers, contacts, etc.

METERS

20—72. What has been the experience of member companies with polyphase rotating testing standards?

(Other Replies in February and March BULLETINS.)

The Nevada-California Power Company, George M. Wills, Superintendent, Goldfield, Nevada.—This company has used the Westinghouse single phase and polyphase rotating standards for watt-hour meter tests for the past two years, and have found them very convenient and satisfactory in the results obtained.

20—75. When a meter reader or inspector finds a "jumper" around a meter, what is the customary procedure to obtain conviction and punishment of the customer?

(Other Replies in March BULLETIN.)

The Nevada-California Power Company, George M. Wills, Superintendent, Goldfield, Nevada.—We have found that in a few cases the discontinuance of service and the confiscation of their meter deposit was cause for sufficient

embarrassment to the offenders to be a warning to others not to try to do the same thing. There are instances, however, which should be prosecuted to the full extent. We have found that in large measure such temptations are removed by placing the meter on the outside of the house, which is also more convenient for the meter reader.

20—75a. What experience have member companies had with Wright maximum demand meters on three-phase motor installations?

J. W. Cowles, Boston, Mass.—Wright Demand Indicators, being ampere instruments, are not used on alternating current motors or other inductive loads, either single or three phase.

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—We have in some instances installed Wright demand meters to determine the demand on alternating current polyphase installations, using one or two meters. We see no objection in their use in determining the demand for some motor installations.

J. H. Perry, Assistant Superintendent, Commonwealth Edison Company, Chicago, Ill.—The use of Wright maximum demand meters on three-phase motor installations is not practical, owing to the varying power factors on the different phases.

20—76. What has been the experience of member companies with the new 25 cent prepayment meter? What is the average monthly revenue per meter? What do you figure must be secured as the minimum revenue per meter before the installation of this meter pays?

R. D. Rubright, Auditor, Edison Electric Illuminating Company of Brooklyn. —The Edison Electric Illuminating Company of Brooklyn has in use on its system 938 prepayment meters of the 25 cent 2CP3 type. There is practically no criticism to be made as to the accuracy of these meters, either as to registration of current or as to the proper working of the coin device, and the results obtained so far, by the use of these meters, are entirely satisfactory. Based upon experience to date, we do not advocate the placing of prepayment meters in the cellar of apartment houses. We favor the installation of them in the apartment and in dwellings on or above the first floor.

We feel that the company should receive a minimum revenue of not less than $12 per year. If this cannot be secured the prepayment-meter proposition is not a paying one; unless the company cares to consider the use of the prepayment meter as a means of educating the people to the use of electric current.

The average amount of income received per month, from this type of prepayment meter is, in our company, about $1.10. There is no doubt but that our company has secured customers through the use of the prepayment meter that would not have been obtained by any other means. Quite a large number of the customers secured in this way have had their meters replaced with the regular meter. We believe that the prepayment meter is a measuring device which will be used equally as much as the gas prepayment meter within the next few years, and that central stations should co-operate with the manufacturers in developing this device, even if immediate results are not all that is desired. In other words, the work of improving and cheapening the meter can be greatly helped by the companies purchasing them and placing them on their systems.

It is our judgment that the prepayment meter has come to stay.

J. H. Enright, Manager, Frederick Gas & Electric Company, Frederick, Md.—A few years ago I was impressed with the idea of using slot prepayment electric meters. However, about that time our troubles with our gas slots began, which resulted in our discontinuing their purchase entirely, for the following reasons:

1st. They decrease consumption;

2d. There are many elements of danger connected with their use, as compared with the regular meter;

3d. They are a constant temptation to the light-fingered gentry, who fre-

quently rob them. I have no doubt of the electric slot being heir to the above mentioned defects, hence I would not advise their use.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—We are using in Columbus somewhere in the neighborhood of 140 prepayment meters. These meters have been placed where there was considerable trouble experienced in keeping up with the different changes in tenants. So far they have proven very satisfactory, as we have practically no trouble after the meter is installed, and this also eliminates the question of deposits. Our regular guarantee is required on these meters the same as on plain meters.

20—77. What success have member companies had with the "Routine Test on Premises"? What is the comparative cost between this and the "Routine Change and Test"? Which produces best results?

(Other Replies in March BULLETIN.)

A. D. Spencer, Detroit, Mich.—All meters are tested periodically in service. The cost of a test in service is approximately the same as the cost of replacing and testing in the shop.

The results of testing in the shop cannot be compared with results obtained by testing in service, under service conditions. A direct current meter that has been carefully tested in the shop, carefully handled and carefully installed, may be found extremely inaccurate in service. This inaccuracy is due to the difference between shop conditions and service conditions.

A 300-ampere direct current meter which had been carefully tested in the shop was found 70 per cent fast in service, due to the meter wiring. In this case the service entered at the right side of the meter and the load was at the left side, so that the wiring made two half loops around the meter. This was an extreme case; but it is not unusual to find direct current meters 5 to 10 per cent inaccurate on account of service wiring. Alternating current meters may be affected by stray fields, though not to the same extent.

Any meter (D. C. or A. C.) may be affected by vibration or may be injured in transportation. Meters installed where there is severe vibration may be found creeping and may be 10 to 20 per cent fast on light loads.

COMMERCIAL

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

Reduction of an attractive newspaper advertisement used by the Milwaukee Electric Railway & Light Company will be found on page 552.

21—26. We are fighting hard to secure the business of our city to operate their water-works by electric current. Will member companies who supply current to water-works help us with data and information which might aid us in getting this business?

(Also answered in February and March BULLETINS.)

Utah Light & Railway Company, B. W. Mendenhall, Commercial Agent, Salt Lake City, Utah.—We are furnishing power for operating a pumping plant in connection with the city's sewerage system for 21 hours off-peak service, at the rate of one cent per kilowatt hour. They operate a gas producer plant which the city had installed during the hours of our lighting peak. Our franchise requires that we furnish power to the city during off-peak hours at one cent per kilowatt hour, and we are glad to furnish it under these conditions.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—We have in Columbus a 25 horse-power motor operating a centrifugal pump for the water-works system in this city. The current consumption for the year 1910 was 117,770 kilowatt-hours; for the year 1909, 113,050 kilowatt-hours. The amount of water pumped during 1910, was 160,000,000 gallons;

during the year 1909, 175,000,000 gallons. This pump worked against a pressure of approximately 40 pounds.

We also have installed at Phenix City, a town just across the river from Columbus, a 20 horse-power motor which operated a triplex pump. For the year 1909, the current consumption was 28,790 kilowatt-hours; the year 1910, 35,841 kilowatt-hours. We are unable to give the amount of water pumped during these years, as no record is kept at the Municipal Plant. This pump operates against a head of approximately 95 pounds.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

(Other Replies in December, January, February and March BULLETINS.)

Utah Light & Railway Company, B. W. Mendenhall, Commercial Agent, Salt Lake City, Utah.—We have been preparing and are just ready to adopt an off-peak service rate, which we offer to customers with a maximum demand of 50 horse-power or over, with 40 per cent discount on the readiness to serve or capacity charge from our regular unrestricted service rate. We propose to control this off-peak service by occasional inspection. We handle the cooking rate by omitting the capacity charge on this class of apparatus.

22—46. What is approximately the average charge per pair of flaming arcs (commercial lighting) in cities which make special rates for this class of lighting? I believe that we have been selling this light at a price lower than we can take care of these lamps, and I would be very glad to know what others are receiving for such service.

(For other Answers see March BULLETIN.)

Utah Light & Railway Company, B. W. Mendenhall, Commercial Agent, Salt Lake City, Utah.—We make a rate of $18 per pair. The consumer furnishes carbons and we do the trimming.

The Excello Arc Lamp Company, H. Canil, Engineer, Chicago, Ill.—The Commonwealth Edison Company of Chicago have made the following rates:—From dusk to midnight, every night, carbons, globes, trimming and up-keep of the lamp, lamps turned off and on by the Edison Company, $14 per month. Where the Edison Company furnishes the lamps, $1 per week per lamp rental is charged. The Edison Company have approximately 75 lamps in Chicago on this kind of service.

22—47. Wanted: Information from member companies, regarding the amount spent by the cities in which they are located per square mile for street lighting service. In other words, I wish the result obtained by dividing the number of square miles in the city by the yearly appropriation for street lights.

(For other Replies see March BULLETIN.)

Utah Light & Railway Company, B. W. Mendenhall, Commercial Agent, Salt Lake City, Utah.—Salt Lake City, with an area of 44.4 square miles and a population of 92,770 (1910), has installed 835 four-ampere luminous arc lamps, December 31, and paid us during the fiscal year, $45,000. Cost per square mile per annum, $1,010.

E. J. Fowler, Statistician, Commonwealth Edison Company, Chicago, Ill.—The total cost for the year 1909 for the city of Chicago for street lighting, including gas lamps, gasoline lamps, rented electric lamps and municipal electric lamps, was $6,842 per square mile per year. Of this amount $4,335 per square mile is for electric lighting; the remainder is about two-thirds gas lighting and about one-third gasoline lighting.

The Indiana Electric Transmission Company, Jacksonville, Indiana.—$4,800 per square mile.

W. J. Ray, Chief Accountant, Edison Electric Illuminating Company of Brooklyn.—Borough of Brooklyn, City of New York,

Appropriation for Gas and Electric Street Lighting	$1,072,600
Area, square miles	78
Appropriation per square mile	$13,751.28

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—The expense in Los Angeles, including several recently annexed districts, for arc and ornamental street lighting, amounts to $3,200 per square mile per annum.

The Cleveland Electric Illuminating Company, H. J. Davis, Statistician, Cleveland, Ohio.—The City of Cleveland, with an area of 45.9 square miles, appropriated during the year 1910 for electric street lighting $152,618.78; for gas lighting, $159,049; making the total appropriation of $311,667.78, or an average of $6,790.15 per square mile.

British Columbia Electric Company Section, National Electric Light Association, Vancouver, B. C.—$3,590 per square mile.

Foster Olroyd, City Electrician, New Orleans, La.—The corporate limits of this city are about thirty square miles, but of this about twenty square miles only represent settled area. All of the city's arc lights are in the settled area. There are 2,695 overhead-service-fed arc lights, for which the city pays $69 a year for service, and 557 underground lights, for which the city pays $85 a year for service.

[Taking the area at 20 square miles, this would figure $11,665 per square mile; at 30 square miles, $7,776.66.—Ed.]

J. H. Drake, Superintendent of Lighting, Knoxville Railway & Light Company, Knoxville, Tenn.—

1908

Average number of series arcs	350	
Average number of series incandescents	112	
Total expenditure for arcs		$25,380
Total expenditure for incandescents		2,527
Total paid by city for street lighting		$27,907
Amount per square mile		$7,030

1909

Average number of series arcs	357	
Average number of series incandescents	130	
Total expenditure for arcs		$25,928
Total expenditure for incandescents		2,933
Total paid by city for street lighting		$28,861
Amount per square mile		$7,270

1910

Average number of series arcs	368	
Average number of series incandescents	132	
Total expenditure for arcs		$26,831
Total expenditure for incandescents		2,989
Total paid by city for street lighting		$29,820
Amount per square mile		$7,511

No gas is used for street lighting and the figures as given above cover the entire expenditure for electric street lighting. All of the arc lamps are of the Adams-Bagnall enclosed type, 6.6 amperes, 500-watts. All of the series incandescent lamps are 25 candle-power, 87½-watts.

The above figures only include Knoxville proper, and do not include any of the small towns for which we furnish street lighting.

John A. Britton, Vice-President and General Manager, Pacific Gas & Electric Company, San Francisco, Cal.—Following is in answer to this question, covering certain cities under the management of the Pacific Gas & Electric Company:

	Miles (A)	Appropriations (B)	B/A
Oakland	30	$115,000	$3,833.33
Berkeley	9½	18,000	1,894.73
Sacramento	4.05	45,000	11,111.11
San Jose	5	22,000	4,400.00
San Francisco	40	320,000	8,000.00

MANAGEMENT

23—25. What is the average revenue obtained by member companies on electric irons, toasters and sewing-machine motors?

(Other Replies in March BULLETIN.)

E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—It depends somewhat on the rates charged for electricity, but at the rate of 10 cents per kilowatt-hour, the average income from electric irons in large cities is approximately 60 cents per month; from toasters, not more than 20 cents per month; from sewing machines in the home, it would be so small that it is hard to estimate.

23—30. In figuring out the kilowatt-hour output from large central stations for the purpose of obtaining the coal per kilowatt-hour and the cost per kilowatt-hour of the generating station, is it customary to include the total kilowatt-hours generated by the machines, or is the energy consumed by the motor-driven exciters, station lighting and miscellaneous power supply in the station itself, subtracted from the total actual output of the alternators?

Cecil P. Poole, Editor *Power*, New York.—If the object is to determine the efficiency of the plant equipment, the total energy developed by all machinery should be considered. If the desired information is the cost of producing the commercial output of the station, then all power used in and around the plant should be deducted in figuring coal consumption per unit of electrical energy. The logical course, however, is to figure the cost on the total energy actually converted and then charge back that energy used in the plant, as part of the expense of operation.

J. H. Enright, Manager, Frederick Gas & Electric Company, Frederick, Md. —To obtain the amount of coal per kilowatt-hour consumed, and the cost per kilowatt-hour at the switchboard, we use the daily readings of our station meters. We also meter all current used in lighting the station, etc., and cost of same is included in reaching the net cost per kilowatt-hour on our switchboard, and not directly against the coal.

Springfield Light, Heat & Power Company, J. R. Hughes, Springfield, Ill.—In computing station costs and pounds coal burned per kilowatt-hour, the station output should be taken as a basis. By station output is meant the kilowatt-hours available at the switchboard after the energy to supply exciters, station lighting and miscellaneous station uses has been deducted.

Edward D. Dreyfus, Commercial Engineer, The Westinghouse Machine Company, East Pittsburgh, Pa.—It is very evident that only the net should be considered in either determining the fuel rate or cost per kilowatt-hour, inasmuch as there is ordinarily considerable latitude possible in the disposition and arrangement of auxiliary apparatus, such that the economy realized may vary widely.

For illustration, two stations with identical output to the distributing system may be equipped in the one case with steam-driven auxiliaries and with the auxiliaries motor-driven (for argument's sake) in the other, and the former most probably will produce the better economical plant performance, due to establishment of good heat distribution, which, however, would be obscured if the latter was not debited with the power consumed in its electrically

operated auxiliaries. In fact, the lighting and all else in the station which may deduct from the available energy for sale should for similar reasons be taken into account.

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—In computing the kilowatt-hour output from large central stations, it is the practise of this company to deduct from prime-mover output the kilowatt-hours used in the operation of electrically driven exciters, centrifugal circulating pumps, station auxiliaries and all other electrically driven apparatus used in the operation of the power-house for the production of electrical energy at the power-house switchboard. The reason for this becomes at once apparent when we consider that in some large central stations part of the auxiliaries are operated by steam power and part by electricity, while in others, the station auxiliaries are operated entirely by steam. This method of computing the kilowatt-hour output represents the net electrical output of the power-house, which forms a basis for figuring all costs per kilowatt-hour, coal per kilowatt-hour, etc.

Poughkeepsie Light, Heat & Power Company, Arthur S. Ives, Assistant General Manager, Poughkeepsie, N. Y.—The correct method of obtaining coal consumption per kilowatt-hour in central station generating plants is to deduct the energy consumed by all station auxiliaries such as motor-driven exciters, pumps, feeder regulators, stokers, etc., from the total kilowatt-hours output from the generators, dividing the result by the pounds of coal consumed. Station lighting should not be included in the deductions, and only such power as is directly consumed in producing the generated output. The above rule must be obvious if stations using steam auxiliaries are considered for comparison. In this case the power for running the auxiliaries is obtained directly from the coal, and the coal burned for such steam generating is included in the total coal used in the plant.

G. E. McKana, Assistant Statistician, Commonwealth Edison Company, Chicago, Ill.—With the Commonwealth Edison Company, the electrical energy consumed by motor-driven auxiliaries and for station lighting, etc., is deducted from the total output of the generators to obtain the divisor used in figuring station operating costs, fuel consumption per kilowatt-hour, etc. This method charges the station at cost with the energy thus used.

A. D. Spencer, Statistical Department, The Edison Illuminating Company of Detroit, Detroit, Mich.—In this company the net power-house output available for transmission is used in calculating costs and other production data. It seems a reasonable figure to use, as it represents the true available output. It is the only figure that can be used in making comparison with any other type of power-plant, particularly power-plants using steam driven auxiliaries.

23—31. Do our large central station companies in working out the B. T. U. per pound of coal make use of the actual calorimeter measurements, or calculate the heat units by means of formula from the analysis? If the latter case, give formula which you have found particularly applicable to semi-bituminous coals of the eastern district.

Poughkeepsie Light, Heat & Power Company, Arthur S. Ives, Assistant General Manager, Poughkeepsie, N. Y.—I have seen a number of formulas, more or less empiric, which are intended to enable the calculation of the B. T. U. per pound of coal from the proximate analysis, but in testing same against actual calorimetrical results I have never found any that could be depended upon. Our company has been purchasing its coal on specifications for the last four years, with very satisfactory results, and the premiums are based on actual analyses and calorimeter measurements. It would not be fair either to dealer or consuming company to attempt to base a contract relation on calculated B. T. U.

C. A. Lind, Fuel Agent, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company uses the actual calorimeter measurements in working out B. T. U. per pound of coal.

23—32. We are endeavoring to ascertain the best method for dealing with accounts for wiring and material sold, and if it is advisable to record them

separately from light and power charges, so that confusion in the consumer's ledger would be obliterated. Will member companies please give their system of dealing with this question and state if wiring and material items are included as arrears on light and power bills, and also in case of agreement to pay material accounts by installments, how should this be handled?

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—I think it inadvisable to mix up the accounts for wiring and appliances with the accounts for light and power. To take care of the accounting for sundry sales a separate order system should be installed and a sundry sales book and ledger. I would suggest the loose-leaf form of ledger for the sundry sales ledger. Bills for sundry sales should be issued immediately upon the completion of any work or upon the delivery of material or appliances. At the end of the month bills for light or power should show the amount due for sundry sales. If the payments are to be made in installments, the terms should be stated in the ledger account, and collections can be very easily followed up from that ledger.

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—The Kansas City Electric Light Company, in accounting for construction work done for consumers, also material sold, enters such transactions and sales in a separate Accounts Receivable Record. The total billing price of material is posted and credited to an account called "Consumers' Construction," and the cost of material, including freight and cartage, is charged to the above account. At the end of the month an entry is made to take up the accumulated profit or loss in the Consumers' Construction Account, transferring same to income. The collections of such bills are handled separately from the bills for electric service and are in no way shown on the electric light and power bills. At the present time no goods are sold on the installment plan.

Warren C. Pike, Jr., Auditing Department, Edison Electric Illuminating Company of Brooklyn.—Charges for material, jobbing and sundry other items of a like character are included with charges for electric current on our consumers' ledgers. We keep a Miscellaneous Accounts Receivable Ledger, in which are recorded such items chargeable against non-consumers. From the fact that, under our accounting system, light and power items and merchandise items are billed in distinctly different ways, it is an easy matter for our bookkeepers to distinguish between them. Confusion is avoided by inserting the merchandise invoice number on the ledger card and a brief description of the charge opposite each merchandise item. Merchandise items are included as arrears on regular current bills, but electrical current charges in arrears and merchandise charges in arrears are shown separately.

Our only transactions in installment payment business are merely of a financial nature. We act as agent between wiring contractors and parties desiring to have their premises wired for electric service. We advance the cost of the wiring work, which the customer agrees to repay in monthly installments. The routine method in which these installment accounts are treated on our books is as follows:

A suspense ledger is kept wherein is recorded, in a separate account for each customer with whom we have entered into an installment agreement, the agreed price for the work. From day to day, as installments become due, bills for the amounts of installments are rendered and listed in a blotter or journal. From the blotter entries are derived transferring installments from suspense ledger to the customer's accounts in consumers' ledgers. Suspense ledger accounts are thus gradually closed out as bills are rendered, and consumers' ledgers show only the amounts of installments actually due. Installment payment bill forms are different from current or merchandise bill forms.

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—Consumers' ledgers are arranged for all current accounts, such as gas, incandescent, power; all loop charges, lamps and shades are noted upon these ledgers. Also such wiring contracts as we carry. The gas services, gas and electric appliances, are noted upon the petty ledgers. The monthly bill after passing through the hands of the bookkeeper is then delivered

to the bookkeeper in charge of the petty ledgers, and such charges as are occasioned by the purchase of appliances are then entered. Where accounts are payable in installments, the monthly installment is placed on the bill by the bookkeeper in charge of the petty ledgers. The above system proves very satisfactory.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—Our accounts for material sold are kept in separate ledgers and also billed separate from the light and power bills.

H. E. Addenbrooke, Assistant to the Auditor, Commonwealth Edison Company, Chicago, Ill.—Wiring and material sales are handled through our mercantile ledgers; light and power sales through our consumers' ledgers. Separate recapitulations and general ledger accounts are kept for each. Wiring and material items are not included as arrears on light and power bills, or vice versa. In paying for material by installments, the original bill is sent out with the number of installments to pay stamped thereon, and a statement sent each month thereafter.

L. M. Wallace, Boston, Mass.—Our system of accounting provides for the recording of charges for electric service and charges for material, etc., to a customer in one account in the customers' ledger. Individual bills are rendered for sales of material, etc., and the form of bill used in billing sales of electricity provides for showing the total amount in arrears, which is added to the current month's charges for electric service, while the coupon of the bill shows the amount due in detail; thus the customer is enabled to check such individual bills or amounts as are unpaid, should he desire to do so.

Apparatus sold, to be paid for in two or more installments, is billed at the sales price in the usual way, and the amount due is reported to the customer in manner as mentioned above.

Experience shows this method to be entirely practical, and it rarely, if ever, causes confusion in the customer's account. The advantage of showing in one place a customer's total indebtedness is obvious—the routine in connection with the accounts receivable is much simplified; bookkeepers can conveniently and quickly make special statements, and especially are they better enabled to furnish the collection department with the information it requires in collecting accounts.

H. R. Kern, The Philadelphia Electric Company, Philadelphia, Pa.—This company enters bills for wiring and material sold and for light and power all in the same ledger, and in the same column of the ledger. No confusion arises from this, because the bills for merchandise are numbered, and this number is entered in the consumers' ledger at the time the amount is entered. The entry of amount of bills for light and power is preceded in the ledgers by the presentation date, and the absence of this date on the merchandise bills, and the presence of the bill number, serves to distinguish clearly between the two classes of billing. When light and power bills for the current period are sent out, any unpaid balance, for either merchandise or light and power, is inserted beneath the total of said bill, and the total of both the bill and the balance is then set down as the total amount due. In setting down this balance we specify, by means of a rubber stamp, whether the balance is for merchandise or for light or power, or, if both, the balance is so shown.

In regard to the matter of billing material sold on installments, the few cases that we now have are handled as follows:

The total value of the article sold is charged to an installment account and credited to the proper material account. A card record is kept of the date on which installment billing should be made. When these bills are made out, the installation account and the profit account are credited, the consumer being charged.

24—43. Where companies regularly inspect signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat-rate outline and sign work, where competitive electric lighting companies are in the same field?

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—Our signs and outlining operating upon a flat rate basis are

regularly inspected for burned-out lamps, and, where noted, same are renewed. The cost of such renewals is very small in proportion to the amount of revenue secured for this class of business. Were one to figure the cost per lamp per year for this inspection it would be practically negligible. It is good policy to at all times give good service and to provide for the regular inspection of signs and outlining.

21—44. What has been the experience of member companies in promoting, in a systematic manner, suggestions from various employes?

(Other Replies in February BULLETIN.)

COMMONWEALTH EDISON COMPANY

Prizes for Acceptable Suggestions

(Abstract of Advisory Committee's Recommendations Nos. 184 and 216 Relative to Rewarding Employes for Valuable Suggestions for the Improvement of the Service.)

To encourage its employes to be more watchful, studious and interested in Company affairs, the Commonwealth Edison Company will, until further notice, pay $1.00 for every accepted suggestion that is submitted by an employe.

These suggestions, to be acceptable, must tend to a reduction of expenses, improvement of service, or be of aid in securing new business.

The following procedure should be observed in presenting suggestions:

Suggestions must be presented in writing and unsigned. They must be enclosed in a special envelope, sealed, and marked on the upper left hand corner with the name of the Department or Departments to whose work the suggestion applies. This envelope must then be placed within another envelope, the latter addressed to MR. E. A. EDKINS, Secretary Advisory Committee, and marked "Suggestion." The name of the sender and of the Department in which he is employed should appear in the upper left hand corner.

A record will be made of the sender's name and Department and a number will be assigned to this suggestion, after which it will be referred for consideration, without the sender's name, through proper channels to the Head of the Department interested, who will determine whether the suggestion should be accepted or rejected, and his decision the Secretary will make known to the sender of the suggestion.

The exception above referred to applies to suggestions made by Heads of Departments, and of Sub-Departments for improvements regarding their own work, as it is considered that such particular suggestions are included in the duties belonging to their positions.

SPECIAL PERIODICAL PRIZES

For the most valuable and for the greatest number of accepted suggestions submitted during each six months period, the Company offers special prizes on the following basis:

For the three most valuable suggestions:

First Prize	$50.00
Second Prize	30.00
Third Prize	20.00

For the greatest number of accepted suggestions from any one employe;

A Single Prize of $50.00

Department Heads are not eligible for these special prizes.

E. A. Edkins, Secretary, Advisory Committee, Commonwealth Edison Company, Chicago, Ill.—I enclose herewith a notice issued by the Commonwealth Edison Company in June, 1910, offering prizes to our employes for

acceptable suggestions which would tend to bring about a reduction of expenses and improvement of the company's service, or be of aid in securing new business.

Up to the 6th of March, 1911, 313 suggestions had been received from company employes, of which number 60 were accepted, 160 rejected, and 93 under consideration. Up to December 31, 1910, only 100 suggestions were received, but as soon as the first semi-annual award of special prizes was announced, our employes seemed to realize for the first time that substantial prizes were being offered which were within the reach of all, and which were well worth some effort to win. The number of suggestions turned in was at once increased to a notable extent, and we are now receiving an average of 200 suggestions each month.

While many of these suggestions are either irrelevant, impracticable, or trivial, and therefore have to be rejected, there are a sufficient number of really valuable suggestions received to amply justify the company in the expense incurred. Not only have the acceptable suggestions resulted in material economies, or improvements, but they have caused all of our employes to take a much keener interest in their work and to keep constantly on the alert for better methods.

(A reduced reproduction of the notice referred to in the foregoing precedes Mr. Edkins' answer.)

J. E. Harsh, Commercial Manager, The Empire District Electric Company, Joplin, Mo.—It is the policy of the writer to solicit from employes, particularly in the commercial department, suggestions and ideas which will be productive of good to the company, either in a specific or general way. An explanation should be made as to why unadopted suggestions would not prove practical. Such explanations will prove educational and also show that the company is watching and analyzing every suggestion turned in. It is the opinion of the writer that, as a reward for practical suggestions, the employes value honorable mention more highly than money. As a rule, those who contribute are found among the more industrious and earnest workers, the self-satisfaction meaning more to them than pecuniary gain.

24—46. Since the recent hearing before the Interstate Commerce Commission, the papers and magazines have been full of the doctrine of efficiency or scientific management, implying, in general, that in many cases by scientific planning, employes as individuals and the organization as a whole, can accomplish more work with less expenditure of time and effort, thereby enabling individual wages to be increased, and yet a saving effected to the corporation.

Assuming for the sake of argument that scientific management, so-called, can accomplish a large part of what is claimed for it in industrial establishments, and even in railroads, is there any opportunity to effect a similar saving in electric light and power companies?

(Also answered in March BULLETIN.)

John F. Gilchrist, Chicago, Ill.—There is no doubt in my mind but what intelligent and discriminating management, analyzing and studying all of the company's operations (which might be termed scientific management), would be of as great a benefit to the electric lighting and power industry as to any other industry.

It is impossible to cover the subject except in a very general way in the space allowed, but a few illustrations may, in a measure, indicate some of the possibilities. For instance, there is much room for intelligent consideration as to the location and general arrangement of generating stations as well as their operation. A great deal of money can be saved by careful consideration of line building; and small items like the matter of rules providing for the placing of meters where they can be tested and read with the least possible expenditure of time will save money. Many operations performed and records made by the different branches of the company can be so studied out that there will be no duplication of work.

In short, I see no difference between the electric business and any other business with regard to what the application of brains and ordinary common sense may accomplish.

[A reply was received to this inquiry from Mr. L. B. Webster, of the American Gas and Electric Company, New York, relating the results of actual investigations along the line of efficiency engineering, which this company had made in some of its plants. It is an ingenious and interesting exposition on this timely topic, in its relation to the central station industry. It would occupy several pages if published in the *Question Box*, and it appealed to your Editor that it could be more appropriately presented to the coming New York Convention as a paper. This view has met with the approval of the Papers Committee, and Mr. Webster's contribution, after certain amendations and additions by the author, will, therefore, be read as a paper at the coming convention.—Ed.]

24—47. What have member companies found to be the best method of handling free lamp renewals, by periodic renewals or by request renewals?

Do member companies renew the lamps in the socket, or do they deliver them to the door and exchange for the old lamps and let the consumers put them in the sockets, or does the representative of the company go through the house and renew them?

Do member companies consider it a good practise to go through the houses? If so, why? If not so, why?

What is the object of periodic lamp renewals?

(Other Replies in March BULLETIN.)

H. W. Cluthe, Brooklyn, N. Y.—In Brooklyn, free lamp renewals are furnished mainly on request, pass-books being furnished the customer for this purpose. An accurate record of the number of renewals furnished the customer, from time to time, is kept, so as to insure this privilege not being abused.

In addition there is a lamp inspector, who reports all cases where he considers renewals necessary.

The Brooklyn Company, after collecting the old lamps for exchange, delivers the renewal lamps to the customers, who are expected to place them in the sockets.

We do not consider it good practise to go through the houses, as customers are averse to having men with whom they are not personally acquainted traverse their premises. It is, therefore, felt that request renewals operate satisfactorily in this respect.

C. C. Paver, Superintendent Lamp Renewals, Commonwealth Edison Company, Chicago, Ill.—(a) We have found the request system by 'phone or letter for lamp renewals to be the most successful. We maintain a 24-hour delivery.

(b) Our representatives do not replace the lamps in the sockets, but wait a sufficient length of time for consumer to remove them, consumer to install same in fixtures later.

(c) We consider it would be impracticable to go through the premises and renew the lamps in the fixtures. This would materially decrease the number of deliveries per man per day, due to time consumed in removing shades, etc. We would be responsible for damage caused by our representatives. We do, however, install all tungsten lamps in fixtures, leaving same in good burning condition.

(d) We do not maintain a periodic lamp delivery.

24—48. We are contemplating putting in an ice- and cold-storage plant in connection with our water and light plant. What do you think of the advisability of this addition? The ice consumption of our town (2,000 inhabitants—location, West Virginia) is now furnished by an old plant that is not going to run any longer on account of much needed repairs.

F. T. Williams, Sales and Contract Agent, Roanoke Railway and Electric Company, Roanoke, Va.—You ask, "What do you think of the advisability of this addition?" Individually, we would suggest that you find some live active business man, show him that there is money in the ice business, help him to promote a company to make ice, give him all the assistance possible, then sell him the power. We hardly think it advisable for a public-service corporation to branch out in other industries.

John C. Parker, Rochester, N. Y.—An answer to this question would be valueless unless made by a competent engineer after a specific study of the

conditions attending the individual installation. As a general proposition, however, it may be said that with the presumably good price that can be secured for artificial ice in a southern location, and with the operating advantages from combining ice-making with the central-station business, the chances are that it would be a good venture. Among the advantages is the fact that the boiler-room annual-load factor can be kept high, and the boiler efficiency by the same token raised to a very fair point through the diversity factor of the two loads, the winter electric peak in a small town like this being, in general, very pronounced, while the refrigerating peak load comes in the summer. The same advantage applies, though to a somewhat lesser degree, in the distributing over a large volume of business of the overhead and superintendence costs, a part of the station labor, etc. Some advantage, too, must be expected from the combination of two industries whereby purchasing can be more advantageously carried on.

[Replies to question 24—41 in the February issue of the BULLETIN are of interest in connection with inquiry 24—48. In reply to 24—41, eleven separate companies in different parts of the country, who are operating ice plants in connection with central stations, gave their testimony as to the advisability of combining these two enterprises. The balance of evidence is strongly in favor of the combination, especially in small communities where there is not much summer lighting business, and where little additional labor is required to operate the ice plant.

In the March 2d issue of the *Electrical World* is an interesting article and an equally interesting editorial on this subject of central-station ice-making. The experiences cited by those engaged in this business are all favorable to the combination.—Editor.]

24—49. Do member companies allow vacations to all employes, and, if so, what length of time is allowed to different grades of employes, i. e., does a long term of service entitle an employe to a greater vacation than a short term?

(Other Replies in March BULLETIN.)

Utah Light & Railway Company, B. W. Mendenhall, Commercial Agent, Salt Lake City, Utah.—Our offices close Saturday afternoon at one o'clock throughout the year, and employes affected by this closing receive no regular vacation. Station operators, trouble men, and employes who work Saturday afternoons, Sundays and holidays receive an annual ten-day vacation.

British Columbia Electric Company Section, National Electric Light Association, Vancouver, B. C.—All our employes who have been with the company more than 12 months are allowed 10 days' vacation every year, with full pay; no greater vacation given to anyone on account of longer term of service.

24—52. If a customer's meter tests 10 per cent fast, at 1-10 load, and O.K. at 3-4 load, upon what basis should a rebate be made to the customer? Have any of the State Commissions ruled upon this question?

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—It would depend whether a customer was a residence customer or a store customer. In the case cited, if a residence customer, I would say that a proper rebate would be the average between the per cent fast at the light load and accuracy at full load, which would be five per cent. In the case of a store customer, no rebate would be allowed on this showing. I think the above would be a fair way to handle the proposition in the absence of any company ruling or the ruling by the State Commission. I do not know of any rule promulgated by a State Commission on this subject.

Travis H. Whitney, Secretary, Public Service Commission for the First District, New York.—The Public Service Commission for the First District tests electric meters on three loads, viz: one-tenth load, normal load and full load. The final average accuracy of the meter is arrived at by multiplying the normal load by three and adding the one-tenth and full loads, and dividing the sum by five. As the Commission does not make tests under conditions named in your question, it is, of course, impossible to answer same.

W. C. Berry, Claim Department, Commonwealth Edison Company, Chicago, Ill.—The first thing to be determined is the average load in which the consumer operates. If the meter tested O. K. on three-quarter load and three-quarter load was the average load, no allowance should be made. If the average load cannot be determined, then the normal load should be fixed. If the meter then should be found registering fast on the normal load an allowance should be made equal to the percentage the meter is found fast. There is no State Commission ruling upon this question within the State of Illinois. There is, however, a city ordinance governing the conditions of meters, which ordinance considers a meter commercially accurate if registering within four per cent on the average or normal load.

Louis M. Duvall, Secretary, Public Service Commission, Baltimore, Md.—While the Maryland Commission Law gives this Commission power to inspect and test meters and to order removal of those incorrect and substitute therefor correct meters tested and stamped by the Commission, it does not confer the power of ordering reparation in such cases, leaving that, it seems, to be determined by suit or otherwise, between the customer and the company.

The practise of the inspection department of the Commission in testing electric meters is to average the accuracy of the meter by the use of co-efficient one for ten per cent load and 100 per cent load, and the co-efficient two for fifty per cent load.

Rufus W. Spear, Clerk, Public Service Commission of the State of Vermont, Newport, Vermont.—This Commission has not ruled on the matter in question.

A. N. Barber, Secretary, Board of Public Utility Commissioners for the State of New Jersey, Trenton, N. J.—This Board has made no ruling upon the matter.

J. N. Cadby, Inspector of Electric Service, Railroad Commission of Wisconsin, Madison, Wis.—The Railroad Commission of Wisconsin has made no ruling with regard to rebate for incorrect meter registration, but has left this particular matter entirely to the utilities to work out in each individual case. In case the consumer was not satisfied with the adjustment the company proposed to make, the matter could of course be appealed to the Commission. Thus far no such case has come to the attention of this Commission. In case such a matter came up, it is probable that the way in which the particular meter was used would be taken into account in figuring the proper rebate. The Commission requires that meters be tested on three loads rather than two, and in a case where the meter was never used at light load, the light load error would carry little if any weight in determining the proper rebate. I believe the New York Commission has a system of weighting the errors at various loads in determining the average registration.

G. E. McMullen, Brooklyn Edison Company.—It is this company's practise to test meters for accuracy at three periods of load—one at 10 per cent load, one at normal load, and one at full or 100 per cent load. The result of test at 10 per cent load and at 100 per cent load are added together with three times result of test at normal load; the total is then divided by five to get the average per cent accuracy of the meter. If meter on this test proves to be recording fast, the allowance is made to customer, on one-half the period from last calibrating of the meter. For example:

Test on 10 per cent load of meter shows	....	110	per cent
" " 100 " " " " " "	....	100	" "
" " Normal " " " " " "	106.2% × 3	318.6	" "
Dividing by		5)528.6	
Gives average per cent accuracy of meter as found		105.7	per cent

If customer has consumed 1250 kilowatts between previous calibration of meter and this test, allowance on half this amount is credited to customer's account; the allowance is based on half this period of time between tests, as actual time meter started to record inaccuracy is not known and company shares the doubt with the customer.

The Public Service Commission of New York State recognizes commercial accuracy of meters when within four per cent of 100 per cent and approves the above method of testing meter and allowance on claims.

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—The following quotation is from Section 7 of Ordinance 6608:

"An Ordinance Creating the Office of Inspector of Electric Meters, Providing for an Assistant Inspector, and Fixing the Salaries Thereof, Providing for the Establishment of a City Laboratory and for the Purchase of Instruments Therefor, Prescribing the Duties of Said Office and the Methods and Manner of Testing Electrical Instruments, Fixing a License Tax Upon Electric Meters, and Repealing Other Ordinances."

Ordained by the Common Council of the City of Kansas City, Missouri, October 10, 1910.

"Section 7.—Any meter not in excess of two and one-half per cent fast, or two and one-half per cent slow, on an average load, shall be deemed commercially correct. If the meter is found, upon completion of the test, to be more than two and one-half fast or two and one-half per cent slow, the said inspector shall then and there recalibrate and leave the same operating accurately and approved by said inspector, or if the meter be broken, or if for any other reason it is not practicable to recalibrate the same, then the inspector shall order said meter removed and a new meter put in its place. The owner of the meter furnishing the current shall have the right to have a representative present at each and every test and recalibration; such representative, however, shall be permitted to be present throughout the same and to take notes thereof."

The average accuracy is obtained by testing on three different loads, as follows: 1/10 load, ¼ load and ¾ load. The results of these tests are then added and divided by three to obtain the average accuracy.

If the meter tests out more than 2½ per cent fast, rebate is made to the consumer according to Section 8 of the same ordinance.

"Section 8.—If the meter shall be found to be over two and one-half per cent fast, the seller of the current shall within fifteen days after notification of such fact by said inspector refund to the consumer an amount equal to the percentage the same is found to be fast on the bills the consumer has paid for current, from the day said meter was recalibrated or removed back to two preceding months' regular readings, such period not to exceed ninety days, or be less than sixty days, and in the event the meter has not been installed for over ninety days, the period for adjustment shall date from the day said meter was set. Such refund shall be paid to the consumer at the address given by the consumer on his contract. If the same is not paid to the consumer within thirty days after such notice by the inspector, the seller shall then be liable to the consumer for twice the amount of such refund, and the consumer shall have the right to withhold further payments from the company until this double amount is made good. If, however, the consumer is indebted to the seller of current at the time such refund is due the consumer, the seller may deduct from the refund such amount and credit the consumer therewith."

Walter R. Boyd, Manager Lighting Inspection Department, The New York Edison Company.—It may be of interest to quote a portion of the Public Service Commission law, chapter 429, laws of 1907, article 4, section 67, the last paragraph of which reads as follows:

> "If any consumer to whom a meter has been furnished, shall request the Commission in writing to inspect such meter, the Commission shall have the same inspected and tested; if the same on being so tested shall be found to be, four per cent if an electric meter, or two per cent if a gas meter, defective or incorrect to the prejudice of the consumer, the inspector shall order the gas or electric corporation forthwith to remove the same and to place instead thereof a correct meter, and the expense of such inspection and test shall be borne by the corporation; if the same on being so tested shall be found to be correct, the expense of such inspection and test shall be borne by the consumer."

As a matter of fact we have not been required to change any meters where they could be recalibrated on the premises.

Tests are made on a 10 per cent load of the rated capacity of the meter, on normal load—depending on the normal operating conditions—and on 100 per cent load. Any allowance, should the meter be over recording by four per per cent or more, is based upon the average accuracy, which is obtained as follows:

The value of three units is given to the normal load test, while the value of one unit each is given to light and full load tests. The average of this is taken which represents the final results of the test.

Ross B. Mateer, Power Engineer, The Denver Gas & Electric Company, Denver, Colo.—The rebate made to the customer would depend upon the load at which the meter ordinarily operates. In nearly all cases originating among residence consumers it is customary to allow the rebate upon the 1/10 load.

J. S. Kennedy, Secretary, State of New York Public Service Commission, Second District, Albany, N. Y.—The Comission for the Second District has made no ruling in regard to rebates on bills for electrical energy in cases where meters have been found to over-register beyond the legal limits.

The practise of the Commission has been to make a thorough test of electric meters which have been complained against, and to report the results of this test to both the company and to the consumer. The matter of rebates on bills has been left for adjustment between the two parties concerned, and to date the Commission has not been called upon to arbitrate in any cases of this kind.

Thomas W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—In settling with this customer, we should think it advisable to know what his average load is before making him any allowance for fast meter. Should his average load be 10 per cent of the capacity of the meter, then it would be advisable to allow him from six to ten per cent on his bill for the previous three months, unless the last month's bill was a considerable increase over the previous month; then, the rebate should be allowed only on the last bill rendered.

Joseph D. Israel, District Manager, The Philadelphia Electric Company, Philadelphia, Pa.—We test our meters at 10 per cent, 50 per cent, and between 80 and 100 per cent load. We call the meter commercially correct and make no allowance to the consumer if the meter is within 5 per cent of accuracy, either slow or fast on the general average—considering that a 5 per cent discrepancy at the average load does not warrant our giving the consumer any adjustment on the bill in question. We are guided by the average conditions of the meter under these various loads, with particular reference to the average load at which the meter is used by the consumer.

Take the specific question: 10 per cent fast at one-tenth the load, and O.K. at three-quarter load—such conditions would not warrant any adjustment because the probabilities would be that the consumer would use the load under average conditions between 50 and 75 per cent load. Therefore, 10 per cent fast at one-tenth load would be a condition under which the service would be used to a very small extent, and, at the most, would not mean much.

Laurent Heston, Manager Electric Department, Orange County Lighting Company, Middletown, N. Y.—The following are rules of the Public Service Commission, Second District, of New York State:

RULES FOR CONDUCTING COMPLAINT TESTS

11. All meters, whenever possible, shall be tested at three loads: one-tenth of the full-rated capacity of the meter, normal load, and full-rated capacity of the meter.

The average of these tests, obtained by multiplying the result of the test at normal load by three, adding the result of the tests at one-tenth capacity and full capacity and dividing the total by five, shall be deemed the condition of the meter, and such final average shall be reported to the Commission on the form prescribed by it.

12. In an installation where it is impossible to obtain a load of 10 per cent of the rated capacity or 100 per cent of the rated capacity of the meter, tests shall be made at the nearest obtainable loads to 10 per cent and 100 per cent of rated capacity of the meter and values given in the ratios as stated above.

13. The following classification, in percentage of installation, shall be used in determining normal test load:

CLASSIFICATION OF INSTALLATION TO BE USED IN TESTING METERS AT NORMAL LOAD

A—Residence and apartment lighting	25 per cent
B—Elevator Service	40 " "
C—Factories (individual drive), churches and offices	45 " "
D—Factories (shaft drive), theatres, clubs, entrances, hallway and general store lighting	60 " "
E—Saloons, restaurants, pumps, air compressors, ice machines and moving picture theatres	70 " "
F—Sign and window lighting and blowers	100 " "

When a meter is found to be connected to an installation consisting of two or more of the above classes of loads, the normal load used must be obtained by taking the average of the percentages for the classes so connected.

14. Three tests shall be made at each load at which the meter is tested, but should any two fail to agree within one per cent, additional tests shall be made until three results are obtained which do not vary, one from another, more than one per cent.

24—54. What companies maintain a reference library in their main office building? What is the nature and extent of such libraries, i. e., approximate number of volumes and character of books and publications? Is library open to all employes, or to officers and heads of departments only?

L. D. Gibbs, Boston, Mass.—The Edison Electric Illuminating Company of Boston, maintain a library in their building for employes, with about 3000 volumes on electricity and related subjects with numerous bound publications and reports. They also subscribe for about 50 publications for use in the library.

H. O. Stewart, Rochester.—Our company does not maintain a reference library for its employes. The engineering department has a library of approximately 800 volumes and publications, which are the personal property of the department members The library consists of complete sets of the Transactions of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, and other engineering organizations; bulletins of the United States Geological Survey; census reports; bulletins of Bureau of Standards; bound volumes of the leading engineering papers; books on electrical, steam, gas, civil, hydraulic, mechanical engineering; heating, ventilating, etc.

A. H. Manwaring, Chairman Library Committee, Philadelphia Electric Company, Philadelphia, Pa.—Our library is not a public library—it is the library of the Philadelphia Electric Company Section of the National Electric Light Association, but all employes of the company are privileged, in fact encouraged to use it. The library is available to the employes during the regular office hours and is maintained by an appropriation from the company. We have 378 books and 102 periodicals, making a total of 480, all of which are technical and relate to engineering and commercial subjects.

A. Raberg, Secretary Educational Committee, New York Edison Company. —The New York Edison Company maintains a reference library located on one of the floors of the auditorium, 44 West 27th Street. There are in this library 726 bound volumes classified as follows:

311 Electrical Engineering,
102 Mechanical Engineering,
38 Mathematics, Chemistry, etc.,

25 **Miscellaneous,**
50 **Dictionaries and Encyclopedias,**
200 **Magazines, Indexes, Transactions, Journals and other technical periodicals.**

In addition to the above, there are in the library (unbound) 51 weekly, monthly and annual technical and non-technical periodicals and four daily newspapers. The library is for the use of all of the employes of the company, and its affairs are managed by the Educational Committee of the Association of Employes of The New York Edison Company.

(Miss) A. B. Fraser, Librarian, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Company maintains a reference library of over 1500 volumes in their Adams Street building, as well as a working collection at one of the large generating plants and a branch library in the Market Street office building, totaling about 2500 volumes. The books are selected along the lines of electrical engineering with a fairly large representation in the allied branches. The usual reference books are on hand, such as dictionaries, encyclopedias, indexes, hand books, etc., as well as bound volumes of the principal electrical mazagines and complete files of Proceedings, such as the National Electric Light Association, American Institute of Electrical Engineers, Western Society of Engineers, etc. The periodical list of about 80 subscriptions covers a rather broad field, having a representation of the best English, American and German technical journals, as well as a few purely literary magazines. The library is for the use of all employes and contains a deposit station of the Chicago Public Library which supplies the purely recreative reading. Reference and bibliographic work is done for any member of the company.

25—11. Would like to have copies of or information concerning laws governing the appointment of and duties of municipal inspectors in cities and towns where it is necessary to have an inspection previous to the installation being connected to central-station service.

(Other Replies in March BULLETIN.)

E. J. Richards, General Manager, Gardner Electric Light Company, Fitchburg, Mass.—About a year ago an article was inserted in the town warrant for an appointment of an electric inspector. No ordinances were passed relative to his duties and for the past year he has made inspections complying with the rules of the Board of Fire Underwriters. At the present time the inspector practically has no standing. The following amendment to the By-Laws of the Town of Gardner, covering duties of the said inspector, is under consideration, and will probably be adopted.

"Section 1. Every corporation or person proposing to place wires designed to carry a current of electricity within a building, shall give notice thereof to the inspector of wires of this town, before commencing the work; and shall not turn the current on to wires that are to be used for electric lighting, heating or power, until permission to do so has been given by said inspector."

"Section 2. The inspector of wires is hereby authorized to enforce the rules and regulations as contained and provided in the current edition of the National Electrical Code of the National Board of Fire Underwriters, for the installation of electric wiring and apparatus, and in accordance with the provisions and requirements therein contained."

MISCELLANEOUS

0—84. What attempt is being made to standardize the charging plugs for electric vehicles? We have recently had to provide five different plugs.

Utah Light & Railway Company, B. W. Mendenhall, Commercial Agent, Salt Lake City, Utah.—I wrote to the secretary of the Association several months ago, suggesting that the Association take the matter up with manufacturers and endeavor to have them standardize not only electric vehicle charging plugs, but plugs for electric flat irons, toasters, stoves, and similar

apparatus consuming current, so as to save the consumer the expense of purchasing a cord and plug for each piece of apparatus added to his equipment. I think this is a desirable thing and should be followed up to a conclusion. [This suggestion was referred by the Executive Secretary to the Electric Vehicle Association.—Ed.]

George H. Jones, Power Engineer, Commonwealth Edison Company, Chicago, Ill.—The various parties interested in the matter of electric vehicles fully realize the importance of having a standard plug, although at the present time no one plug has been agreed upon. This matter is now being taken up by the Electric Vehicle Committee of the National Electric Light Association.

Alexander Churchward, General Electric Company, New York.—We are trying to standardize charging plugs for electric vehicles, but have a very difficult problem on our hands, as each of the different manufacturers has a type of his own. We eventually hope to be able to get this whole thing boiled down to two plugs: one for pleasure vehicles and small commercial vehicles and one larger for the heavier type of commercial vehicles.

Edison Storage Battery Company, W. G. Bee, Manager of Sales, Orange, N. J.—The Electric Vehicle Association have under consideration standardization of charging plugs and it is now up to the committee to make a report.

Arthur Williams, Vice-President, Electric Vehicle Association of America, New York.—Standardization of electric vehicle charging plugs is now being considered by the Standardization Committee of the Electric Vehicle Association of America. The committee has held two meetings on the subject, and the last report was that drawings and specifications had been prepared on a concentric type of plug, somewhat similar in size, weight and price to the plugs now used by the pleasure car manufacturers, and which would be acceptable to the commercial car interests.

2—4. What has been your experience with the operation of automatic, or mechanically operated relief valves connected to the wheel cases in water-power plants, and are they absolutely necessary? Please state conditions under which they were used.

W. N. Ryerson, General Manager, Great Northern Power Company, Duluth, Minn.—In connection with the Prime Motive Powers Committee of the Association I have recently sent a circular letter to some 250 member companies of the Association, asking for information as to various operating points relating to water-power plants. One of the questions asked covers almost identically the ground of the present question.

I may say that the consensus of opinion seems to be that in plants utilizing heads of from fifty feet and upwards and where penstocks are used, having a length approximately equal to twice the operating head, good speed regulation is very much assisted by such relief valves, and further, that their use may prevent rises in penstock pressure which may endanger the penstocks themselves.

There is a great diversity of opinion as to the proper method of operating these relief valves, whether by rise in pressure or mechanical connection to the governing mechanism, or both. In our own plant, operating under a head of 375 feet and having a length of penstock of approximately 6,000 feet, each unit was provided with two relief valves, the intention being to operate one by rise in pressure and the second one to be connected to the governing mechanism, so that it would be opened as the gates of the wheel were closed. The closing of this latter valve was intended to be accomplished through a dash pot, whose time of operation could be adjusted so that practically any pressure rise could be cared for.

After the plant was started it was found that the automatic device made good speed regulation more difficult and this was therefore eliminated and both of the relief valves are now connected to the governing mechanism.

I might add that we have in addition to the relief valves a stand pipe near the power station, which is of great assistance in maintaining a uniform penstock pressure, and with this stand pipe and with the relief valves as at

present connected we are getting almost ideal speed regulation under load conditions which are severe.

The use of relief valves in small low head plants (under fifty feet) may in some cases assist in getting good speed regulation, but their use is otherwise not essential.

F. O. Blackwell, of Messrs. Vielé, Blackwell and Buck, New York—Relief valves are required only on plants with long pipe lines where the quick operation of the governor would cause too great an increase in pressure in the pipe line and water wheel casing.

There are two types of relief valves, one operated positively by the governor of the water wheel and the other operated by increase of pressure in pipe line. The same relief valve may be arranged to operate either way, and they are made so as to close slowly after opening. The positively operated valve can be made to work synchronously with the water wheel gate so that the flow of water in the pipe line is constant. This is only necessary under extreme conditions of fluctuating load and a very long pipe line.

For instance, the Necaxa plant of the Mexican Light & Power Company has 2200 feet of pipe line between the standpipe and the power-house, with 300 feet of standpipe, making a column of water 2500 feet long back of the water-wheel. With a maximum velocity in pressure pipe of 18 feet a second, a positively operated by-pass relief valve with a slow-closing attachment permits quick closing of the nozzles of the impulse water-wheels. The ordinary gradual changes in load are taken care of without the by-pass discharging any water. A sudden change in load, or a short-circuit on the line causes the by-pass to open, after which it slowly closes so as to economize water. The connection between the governor and the by-pass is through a dashpot, so that ordinary slow motions of the governor do not effect the by-pass valve. With a station subject to a fluctuating load, the dash-pot would be cut out and the by-pass opened when the nozzle closed and vice versa, giving the same effect as a deflecting nozzle.

J. J. Cagney, General Manager, Central Georgia Power Company, Macon, Ga.—In the case of long penstocks, automatic valves may be necessary to relieve the high pressure set up by suddenly checking the flow of large volumes of water, but on short penstocks such as those installed in our power-house, same are not required, open vents being better suited for the purpose.

H. H. Sinclair, Vice-President, Great Western Power Company, San Francisco, Cal.—We operated for two years without relief valves a power-house containing four 10,000-kilowatts vertical units, each connected to an 18,000 horse-power turbine. Three-hundred and fifty cubic feet per second of water was delivered to each of these units under an operating head of 442 feet through a pipe line five feet internal diameter and 575 feet long. These individual penstocks were joined through one main header pipe to a tunnel of 220 cubic feet cross section and 15,038 feet in length. The entire conduit from the intake tower at head of tunnel to the water-wheels was under pressure, so that the wave action resultant from opening or closing the water-wheel gate was transmitted through the entire length of the conduit.

In January, 1911, we completed the attachment of an automatic pressure regulator to each water-wheel unit through a flanged opening originally provided by the water-wheel manufacturers. This opening, however, was only large enough to permit the passage of approximately 60 per cent of the water used at the full load on the generator, and results were not so entirely satisfactory as if we had been able to by-pass the entire amount of water.

This power-house was connected to a system having about 2000 miles of main line distribution and was subject to very severe short circuits, causing fluctuations as high as 20,000-kilowatts in the load. While the governors on the main units were well suited to their work, the water surges resulting from closure of the gates was so severe as to cause serious difficulty in our speed and voltage regulation. The installation of these regulators has practically eliminated this trouble, and we feel well satisfied with their results. The maximum pressure rise on the individual penstock with full load suddenly thrown off one unit is only one-third of the rise occurring without the regu-

lator, although, as above stated, we are only able to by-pass 60 per cent of the amount of water. The pressure rise on the main header pipe caused by throwing full load off one unit with the pressure regulator attached is so slight as not to in any way disturb an adjacent machine which was temporarily being operated alone on a separate line.

For the economical use of water, these regulators are designed to automatically close and stop the flow within 60 seconds. They are, of course, connected to and operated directly by the main governor, and opened, in so far as possible, proportionately to the amount of closure of the gates, and vice versa.

It will be noted that the operating conditions of the plant mentioned are very severe, as the head on the turbines and the load fluctuations are unusually great. I consider that in most cases the installation of some such regulation is advisable, and in the case of long penstocks handling large volumes of water under high velocity and with severe fluctuations of load, they are an absolute necessity.

NEW QUESTIONS

0—36. We are charged and pay a fee of $1 to the Fire Underwriters Association for "inspection" of each new service we install; this separate from and in addition to the fee charged to the consumer for inspection of interior wiring and fixtures. Is this the custom in other large cities? Do the underwriters make a separate inspection of new services installed, and collect the inspection fee from the central station, as they do in our case?

10—44. What effect has power factor on efficiency of generators, distribution, motors?

10—45. At a certain station the equipment is loaded to the limit the greater part of the day, and at times the equipment is inadequate to supply the peak loads which, are not only momentary. The generators are driven by steam engines. Which would be the more economical and efficient to make up this deficiency, to install a synchronous motor, or an induction generator connected to an exhaust turbine? The latter, of course, would run idle except during heavy load periods when the maximum exhaust steam is delivered to turbine and runs same as an induction generator.

12—46. (a) Have member companies experienced trouble from the wireless telegraph stations effecting their lighting lines?

(b) If so, what protective devices are used and what are your requirements before you will accept a wireless station on your lines?

(c) Have you found cases where these wireless stations were installed on your lines without your knowledge of same; and if so, what action have you taken?

(d) Do you require separate service, separate transformer, and separate meter for each installation? If so, do you bill the consumer at the regular lighting rate? Do you make any charge for connection?

12—47. If all the station output of single-phase, 2300-volt, 60-cycle current for incandescent lighting is metered at the station and all the customers are on meters, in a town of 5000, what proportion exists in actual practise, between the total consumption as indicated by the customers' meters and the total output of the station as indicated by the station meter? In general, what per cent of the loss is chargeable to line, transformers, meters—what else?

12—48. We operate two 11,000-volt transmission lines, each approximately fifteen miles long. Near the end of each line a tap-off is made to supply large customers with power. Will member companies please advise what method they

take to make high potential line tests on their transmission lines; also how they locate grounds or open circuits on such transmission lines?

12—49. Do member companies find it practicable to have linemen's hatchets equipped with a leather thong or rope to slip over lineman's wrist while he is using hatchet at work on pole above ground, in order to prevent injury to persons on ground, should hatchet slip from his hand?

15—55. Has any member company experienced trouble, while operating in parallel banks of three transformers, connected three-phase, by having one bank take more than its correct proportion of load, due to unbalanced voltage? If so, what measures have been taken to overcome the difficulty?

15—56.—Kindly explain as to the method of checking the ratio of current transformers on high voltage in central stations. Kindly give data, etc.

16—42. What experience have member companies had in regard to burning 250-watt tungsten lamps on an angle of 45 degrees, or greater?

19—51. Under what load-factor do the best hydro-electric plants operate?

19—52. What requirements do member companies ask in connection with the installation of elevators, cranes and hoists operated by alternating current motors?

20—77. Have any member companies made any tests with oil for use with meter jewels?

20—78. What companies have had trouble with rust on the iron clock plate on the Westinghouse induction meters? What has been done to eliminate this trouble?

21—27. What member companies have solicitors working exclusively on electric sign business?

In answer mention population, also if the results have been satisfactory, the cost and yearly income per 50-watt equivalent.

21—28. Would like to get from members, data on heating different kinds of buildings, as we find this important in trying to shut down isolated plants. Please give length of heating season, kind of building, pounds of fuel per cubic foot of building for heating season, price of fuel per ton of 2240 pounds, kind of heating system used and pressure required.

21—29. What central stations rent vacuum cleaners to their customers? What rental is charged?

21—30. In the Manufacturer's Record of April 22, 1909, Mr. G. U. Borde described a process by which alcohol, acetic acid and stock food to the total value of $23.81 could be obtained from 2200 pounds of dry green sawdust at a cost of $7. .With a net value of almost $17 per ton for sawdust, and allowing two tons of dust to one of coal, it would be very expensive to burn the sawdust instead of coal. We have been unable to find any place where this process is used and do not know the first cost of the necessary equipment. If the first cost is high it might be possible to install the equipment in one central mill and let them treat the offal of the other plants in their vicinity. We would like to have the benefit of the experience any of the other member companies have had with this process.

21—31. Have any member companies given complete lists of their customers to appliance manufacturers for them to circularize their advertising matter? What have been the results?

22—51. Do member companies consider it absolutely necessary to have a regularly executed contract with all customers before service is connected? The idea is this: grocers, butchers, icemen, milkmen, and other tradesmen regularly supply a service to house-holders, often amounting to several times the cost of the service we render each month, and this is done without a con-

tract, application, or other written memoranda. Is the central station's business so different that it cannot be conducted on the same basis?

23—33. Do central stations draw load curves of their generator stations and substations from midnight to midnight? If not, from what points are the curves generally drawn?

23—34. Will member companies give the cost per kilowatt or per horsepower of their different apparatus:

Boilers, including ash hoppers and grate bars.

Turbines, including generators and condensers.

Station piping, including all steam, feed, exhaust, and blow-off piping in the station.

Electrical apparatus, including high tension and low tension switches, high tension control board, etc.

23—35. What method is employed in keeping books on house wiring agreements where electric light companies advance money to contractors and then collect from consumers on the installment plan?

23—36. What method is employed whereby a perfect check is made on meter constants entered in consumers' ledgers?

24—55. Do any of our member companies maintain a separate department or employment bureau for the purpose of receiving applications, and keeping up a live eligible list of applicants for all classes of work in the service?

24—56. How many of our member companies keep a complete card index record of all past and present employes which may be referred to in answer to questions regarding past and present employes' ages, nationality, education, previous experience, salary, grade, and general record while employed by the company?

24—57. What experience have member companies had in keeping a partial or complete photographic record of all employes?

24—58. Do member companies compel applicants for positions in the electrical departments to undergo a physical examination, and if so does the applicant or the company bear the expense of same?

24—59. How many member companies are making allowances to customers where meters are found fast on routine test? If allowances are made, full detail regarding period covered by rebate will be appreciated.

24—60. Where central stations take flat rate sign or window lighting contracts, how are installations turned on and off, by patrol or clock switch? If the latter, what make or type of clock switch is used and has it worked satisfactorily? What troubles have arisen? Also, if clock switches are not used, how are customers who do not care to avail themselves of a "dusk to midnight" schedule, but want their window lights, for instance, turned off at 9.30 or 10 o'clock, taken care of?

Repeated Questions

The following recent questions have received no reply or else it is felt that further replies are called for and would be of value. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

3—8. Will engineers of large central-station systems who are using the "dry tube" surface condensers, (mentioned in the Proceedings of the National Electric Light Association, of 1909, page 105) give information concerning same as to whether any drawbacks have been encountered since they were installed, whether they are actually giving the results that were mentioned in connection

with the article quoted, and whether higher vacuum can be maintained by this condenser under similar conditions than with the standard condenser without the dry tube addition.

13—14. With what success has lead-covered, steel-armored cable been used in underground construction for series street lighting systems, especially on alternating current systems?

13—15. Have any member companies had any experience with a device known as the Wireless Cable Tester and Trouble Finder, and if so what are the results?

13—23. What would be the best method combining quality and cheapness of connecting temporary street illuminations from an underground system in which no poles at all are used, consumers' taps being taken from service boxes under the sidewalk? Cables, lead covered, run in tile conduits. There are iron poles for trolley wire construction.

14—7. Have any member companies had any experience with the Edison Battery for vehicle work? Would certainly appreciate any information we can get on this subject.

16—37. I would like information regarding all cities where ornamental posts, using other than tungsten lamps, have been installed for ornamental street lighting or for improvement of business streets.

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40- and 80-watt tungsten series lamp.

16—40. We have, during the last two months, been trying out the "Pemco" tungsten arc lamp equipped with 250-watt, 6.6 ampere series Mazda lamps and roughed inside globes, in comparison with 6.6 ampere series inclosed arc lamp with opal inner globes, for street lighting in our city. We would like to hear the opinions of other central stations, if there are any that have tried these lamps, as to the comparative efficiency of the two lamps for street lighting service.

16—41. What experience, if any, have member companies had in the use and installing of the 400- and 500-watt Mazda units, as to life and methods of installing?

17—30. This company has been trying to get a company prominent in the development of lighting fixtures to furnish fixture for inverted lighting with a reflector and outer casing of glass, the outer casing being dense enough and so tinted as to bring the light value to about that of the ceiling above thereby avoiding the dark underbody of the fixtures now generally used for this work, with the sharp contrasts involved.

A fixture of the above description would be especially suited to rooms where fixture itself is often in the line of vision, such as bed-rooms, hospital wards, etc.

Would there not be a considerable demand for such a fixture?

17—32. On page 87 of the "Solicitors' Handbook" a table of Reflection Coefficients is given. Where would Holophane reflectors stand on this table, if inserted?

17—33. When member companies replace or have replaced outside Nernst lamps in front of customers' premises, with tungsten lamps, what sort of fixture unit is used?

19—50. Have member companies been successful in securing power contracts for the complete operation of (a) breweries, (b) laundries?

If so, under what conditions were the contracts secured?

20—75. What experience have member companies had with Wright maximum demand meters on three-phase motor installations?

20—76. Will some member company give information in regard to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

20—76a. What has been the experience of member companies with the new 25 cent prepayment meter? What is the average monthly revenue per meter? What do you figure must be secured as the minimum revenue per meter before the installation of this meter pays?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

23—31. Do our large central station companies in working out the B. T. U. per pound of coal make use of the actual calorimeter measurements or calculate the heat units by means of formula from the analysis? If the latter case, give formula which you have found particularly applicable to semi-bituminous coals of the eastern district.

24—43. Where company regularly inspect signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat rate outline and sign work, where competitive electric lighting companies are in the same field?

24—54. What companies maintain a reference library in their main office building? What is the nature and extent of such libraries, i. e., approximate number of volumes and character of books and publications? Is library open to all employes, or to officers and heads of departments only?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

25—10. What states have statutes giving the right of eminent domain to power generating and transmission companies for pole lines? Is there available a pamphlet or book containing copies of all existing statutes covering this point?

28—1. Have any member companies had any experience in installing a street lighting system, composed of combination lighting and tramway poles, using multiple tungsten lamps? We particularly desire to know whether an increase in cost of maintenance is found, resulting from vibration of poles, etc.

National Electric Light Association

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THIRTY-FOURTH CONVENTION—NEW YORK
May 29-June 2, 1911

NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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May 20, 1911

CONTENTS

THE NEW YORK CONVENTION

In this issue of the BULLETIN appears a full and final programme for the thirty-fourth annual convention, which will be held in the Engineering Societies Building during the week May 29-June 2. It will be seen that four full days of work are provided, with a crescendo on the last day, while the topics to be presented at the various meetings cover practically the whole range of the art and industry. So complete a programme has never before been presented to the Association, if only for the reason that the central-station field is constantly expanding, and each year new subjects arise for consideration and settlement. A business that ranges, on one hand, from the individual lamp or domestic flatiron to the operation of a huge factory or the energizing of main railroads is likely to appeal to the widest knowledge and the largest ability—and that business is in our hands.

The advance registration would indicate an attendance far beyond anything previously known. The actual registration at St. Louis was 2682, and now, ten days before the con-

vention opens, that figure has nearly been reached. That 3500 to 4000 persons will be present is a reasonable forecast. It may outrun the upper figure. But the main point is the good that the convention can do. If it does not promote the art and advance the industry we might as well abolish it. The fact that each year sees a greater interest is an indication that the convention meets a real need. Moreover, we have now reached a membership of over 8200, which will probably be 8500 by the time of the convention; and as the membership grows it seems inevitable that the convention should bulk up proportionately.

The gates of New York are now wide open to the visitor, and it is hoped that hospitality not less than real hard work will help to make our start on the second quarter century memorable and pleasant. A full week of entertainment has been provided, and as no single event on that programme clashes with a single item of the real earnest business of the week, we trust that all our members and friends will seize the social opportunity and help in this way also to realize the fundamental principle on which our Association has been built.

ASKING FOR INFORMATION

During the annual convention this month a great deal of information will be presented, chiefly in committee reports, based upon the answers to their inquiries received by various committees. In all, not less than forty committees are reporting, and in almost every instance the committee has sent out a letter, a form, or circular asking for data. On the whole, the response has been large and liberal. It ought to be, for only in this way can a full interchange of knowledge and experience be secured and a basis laid for discussion in the meeting room.

We fear that a great many members regard this process of interviewing by mail as a nuisance, but if they could be stationed at headquarters for a year they would realize how keen and imperative is the constant demand for the latest facts bearing upon one or another phase of the industry. Quite probably they have been among those besieging the Association office for such data—and the *Question Box,* with its 50 or 60 pages each month, shows how infinite in variety are the real, vital problems that spring to the front for solution. An excellent editorial article appears on this subject in the April *Selling Electricity,* which says with truth that the central-station man should regard it as an honor to receive a request for information from an N. E. L. A. committee, and points out that, while these inquiries are too often neglected, if the man himself shows up at any central station he is at once taken in hand and treated as an honored guest. Let us quote:

"Right now, many committees of the National Electric Light Association are soliciting various data from central-station men. In the very nature of things, the questions submitted are in printed or mimeographed form and utterly lack the dignity which their importance

would warrant. Coming in quantity and entailing a certain amount of work, they will be tossed aside until a favorable opportunity comes for responding. In the meantime, inquiries and questions from other committees will arrive until the aggregate amounts to a serious piece of work, which the regular daily routine makes difficult. In the end too many of the questions will go unanswered."

Of course, there are many questions that cannot well be answered on paper and are best answered face to face. But the Association can be most useful only when it is used as a clearing house for the data of the industry.

Once in a while, perhaps, there is unavoidable duplication of inquiry. Many fields of work overlap. Sometimes the duplication must be strongly condemned. We may mention an instance. This Association issues each year blanks as to municipal contract street lighting and commercial rates for light, power and heat. It has now in its office six or seven hundred returns, available to all member companies. Yet, as an actual matter of fact, during the past year, two of our member companies, instead of applying to this office for the data, have actually copied our forms literally, even as to size and style, and have sent them out to other member companies to secure the same identical information! It was to prevent such performances that the Association came into existence, and has proved its right to live, and we cannot too strongly deprecate such unnecessary expense and such unnecessary waste of time and trouble.

MAY MEETING OF THE EXECUTIVE COMMITTEE

The Executive Committee of the Association met at the New York offices on May 11 at 11 A.M., and spent the day on work connected with the regular business of the Association and with the coming convention. There were present: Messrs. W. W. Freeman, president, W. H. Blood, Jr., H. A. Wagner, Dudley Farrand, W. C. L. Eglin, John F. Gilchrist, Arthur Williams, Frank M. Tait, A. R. Granger, H. T. Sands, George H. Harries, Frank W. Frueauff, R. M. Searle, T. C. Martin, secretary; E. J. Allegaert by invitation to represent the Committee on Uniform Accounting.

The minutes of the March 9 meeting were read and approved.

With regard to proposed New York State legislation in reference to licensing of engineers, and minimum charge, referred to the president at the last meeting, President Freeman stated that these bills did not seem likely to be passed.

The secretary stated that over 500 applications for the *Question Box* revision had been received from Class B members.

The secretary read the financial statement as of May 1, 1911, showing balance of $24,564.77, exclusive of $15,130.42 invested in bonds and deposited at interest, making a total of $39,695.19, which is about $2,000 increase over last year's balance of May 1, inclusive of contributions to convention fund. The collection of percentage dues for 1911 to date amounted to $14,470.09.

The membership report showed a total membership of 8072, divided into classes as follows: A, 936; B, 6155; C, 19; D, 223; E, 780. The gain in Class A members for the last three years was as follows: 1909, 49

members; 1910, 119; 1911, 86 to date of May 11.

Applications for 32 Class A members were approved, also 13 Class D members. Class B members to the number of 1707 were elected and 55 Class E's.

The following Class C members were also elected: Eugene H. Abadis, of St. Louis; G. G. Mattern, of Rochester, N. Y.; Clement Herschel, of New York, and Wm. McClellan, of Albany, N. Y. The full list of new members appears in the April and May BULLETINS.

Mr. Allegaert presented the Accounting Committee's plan for the establishment of a statistical bureau for the interchange of accounting data by companies. A letter from Chairman Bailey on the subject was also read. Out of 108 replies to a circular letter sent to Class A members, 71 members reported that they were in favor of the bureau and 37 were against it. The Accounting Committee felt that this showed a desire for the bureau.

The matter was very thoroughly discussed by all members of the committee, and the conclusion was that the idea be approved along limited lines and the matter be referred to a sub-committee to submit detailed plans, also showing the probable cost of maintaining the bureau. The chair appointed the following members to serve on the sub-committee: Messrs. Gilchrist, Williams and Searle.

Mr. Allegaert stated that the Accounting Committee also requested that the Executive Committee authorize it to prepare a standard set of forms adaptable to the Association's standard classification of accounts and distribute the same to all member companies. It also submitted for the consideration of the Executive Committee the advisibiliay of the *Accounting Committee* or a sub-committee advocating the adoption of the Association's standard classification by such public service commissions as have not acted upon an accounting standard and where and when new public service commissions are created. On motion of Mr. Wagner it was voted that the recommendation of the Accounting Committee with regard to inducing the public service commissions to accept our classification be referred to the Public Policy Committee.

President Freeman stated that in his presidential address he would recommend that the member companies adopt the classification.

Messrs. Gilchrist and Blood, as members of the sub-committee appointed to investigate the meeting place of the 1912 convention, reported that they were in favor of Seattle owing, for one reason, to hotel accommodations being better there than in Portland. It was moved to hold the 1912 convention in Seattle during the week beginning June 2, place and date subject to making satisfactory arrangements with railroads and hotels.

Mr. Blood stated that there was a tendency to affiliate the Northwestern Association with the National, and that the Northwestern Association was desirous of having the national secretary present at its fall convention to present the matter to them. On motion of Mr. Tait, it was voted that the secretary be requested to make arrangements to attend this meeting.

The secretary reported that the *Question Box* revision was in type and would be distributed after the convention. He also reported that it had been necessary to order an additional thousand Handbooks, owing to the large increase in membership.

The secretary stated that he had received a copy of the amended con-

stitution of the Canadian Association and that it agreed with ours.

Mr. Frueauff, chairman of the Committee on Section Organization, reported a number of proposed constitutional amendments, which were duly approved for submission to the convention for action.

The committee then adjourned for lunch, and spent the afternoon in going over the plans and arrangements for the convention. Chairman Williams, of the Entertainment Committee, and Secretary Martin made full reports.

Mr. H. L. Doherty also joined the committee to discuss plans for the work of the Power Transmission Section at the convention. The committee then adjourned at 4.30 P.M.

By Way of Appreciation

The following are quotations from letters received recently:

I wish to take this occasion to assure you that the *Question Box* is highly appreciated by this department, and many of the answers to various questions are of direct value to us.

ROANOKE RAILWAY AND ELECTRIC CO., VA.

In the March issue I noticed your rearrangement and your very good index to the *Question Box*, which, to my mind, is a long step forward, because to the uninitiated it was almost impossible to find the thing wanted if one had to hunt through so many pages.

COMMONWEALTH EDISON CO., CHICAGO.

The men seem to be taking so much more interest in the *Question Box*, much to my satisfaction, and I find it is steadily growing easier to get a prompt response.

COMMONWEALTH EDISON CO., CHICAGO

Electing Over Seventeen Hundred New Members

When the Executive Committee met on May 11 it had the unusual pleasure of acting on the applications of considerably over 1700 new members. These applications were the accumulation of only two months, and since the last meeting, including the list printed in the April BULLETIN and the one now given. It is believed that no other engineering society ever had so large a gain in so short a time. Diligent inquiry would indicate that it is a very unique performance. The total of members was reported at the meeting as being 8073 net, which was a gain of 2552 since the last annual meeting—once more a record. Since the two lists were voted on, there have been further accessions not now given in the list, and it would seem as though by May 30 the total may reach 8500. The Association may be heartily congratulated on its showing of health and vigor, for the increases have been in all classes of membership and all over the country.

The list given herewith includes 578 names, the elections in each class being as follows: Class A, 19; Class B, 512; Class C, 4; Class D, 11; Class E, 32. These, with the 1163 given last month, make a total of 1741.

The Public Policy Report

A copy of the Report of the Public Policy Committee is sent with this issue of the May BULLETIN, in the same envelope, to all Class A member companies. The report will be taken up at the coming convention, Wednesday, May 31, morning and evening sessions.

THE PROGRAMME OF BUSINESS FOR THE NEW YORK CONVENTION

Subjoined is the programme for the business to be transacted at the New York Convention of this Association, May 29-June 2. It will be followed as closely as possible, but is naturally subject to one or two minor changes:

TUESDAY, 10:00 A. M.

FIRST GENERAL SESSION

1—Welcome to City; 2—President Freeman's Address; 3—Announcements; 4—Report of Committee on Membership—H. H. Scott; 5—Report of Secretary—T. C. Martin; 6—Report of Insurance Expert—W. H. Blood, Jr.; 7—Report of Committee on Overhead Line Construction—Farley Osgood (to be referred for discussion to Technical Session); 8—Report of Committee on Uniform Accounting—John L. Bailey (to be referred for discussion to Accounting Session); 9—Report of Committee on Progress—T. C. Martin; 10—Paper: *Master and Men*—Paul Lupke; 11—Presentation of Billings Portrait.

TUESDAY, 2:30 P. M.

SECOND GENERAL SESSION

1—Report on Bulletin Question Box—M. S. Seelman, Jr.; 2—Report on Question Box Revision—Paul Lupke and Alex. J. Campbell; 3—Report of Library Committee—Arthur Williams; 4—Report of Handbook Committee—Arthur Williams; 5—Report of Doherty Gold Medal Committee—W. C. L. Eglin; 6—Paper: *Compqny and Company Section Bulletins*—E. A. Edkins; 7—Topical Discussion on the Work of the Company Sections.

TUESDAY, 2:30 P. M.

FIRST TECHNICAL SESSION

1—Report of Meter Committee—G. A. Sawin; 2—Report of Committee on Grounding Secondaries—W. H. Blood, Jr.; 3—Paper: *Grounding Low Tension Circuits*—P M. Lincoln; 4—Paper: *Recent Important Improvements in Single-Phase Motors*—W. A. Layman; 5—Paper: *Relation of Motor Load to Station Equipment*—F. D. Newbury.

TUESDAY, 2:30 P. M.

FIRST ACCOUNTING SESSION

1—Report of Committee on Uniform Accounting—John L. Bailey; 2—Paper: *Handling Customers Orders*—R. F. Bonsall; 3—Paper: *The Collection of Bills*—E. J. Bowers; 4—Paper: *Electric Vehicle Accounts as Applied to a Department of a Central Station Plant*—Herman Spoehrer.

WEDNESDAY, 10:00 A. M.

FIRST COMMERCIAL SESSION

1—Address of Chairman of Commercial Section—George Williams; 2—Report of Committee on Power—E. W. Lloyd; 3—Report of Committee on Electricity in Rural Districts—J. G. Learned; 4—Report of Committee on Ornamental Street Lighting—W. R. Collier.

WEDNESDAY, 12:30 NOON

EXECUTIVE SESSION

1—Action on Report of Public Policy Committee—Arthur Williams; 2—Presentation of Proposed Constitutional Amendments—Frank W. Frueauff; 3—Report of Treasurer—George H. Harries; 4—Appointment of Nominating Committee.

WEDNESDAY, 10:00 A. M.

SECOND ACCOUNTING SESSION

1—Paper: *Tracing Store Room Material*—John T. Brady; 2—Paper: *The Purchasing Department*—T. W. Buxton; 3—Paper: *Advantages of a Job Cost System*—Alec. Holme.

WEDNESDAY, 10:00 A. M.

SECOND TECHNICAL SESSION

1—Report of Overhead Line Construction Committee—Farley Osgood; 2—Report of Committee on Preservative Treatment of Poles and Cross-arms—W. K. Vanderpoel; 3—Report of Underground Construction Committee—W I. Abbott; 4—Load Reports of an Electric System—A. S. Loizeaux.

WEDNESDAY, 8:15 P. M.

Public Policy Committee Session—New Theatre

1—Musical Programme under Director Elliott Schenck, musical director of the New Theatre (see separate programme); 2—Presentation of Report of the Public Policy Committee—Past President Samuel Insull; 3—Address: Hon. Charles Nagel, Secretary U. S. Department of Commerce and Labor.

THURSDAY, 10:00 A. M.

First Power Transmission Session

1—Presentation of Report on the April Conference: *Water Powers and Their Governmental Control;* 2—Paper: *Central Station Power Plants for Operating Steam Railroad Electrically*—Fred Darlington; 3—Report of Committee on Protection from Lightning—B. E. Morrow.

THURSDAY, 10:00 A. M.

Second Commercial Session

1—Report of Committee on Electric Vehicles—J. T. Hutchings; 2—Executive Session of Section.

THURSDAY, 10:00 A. M.

Third Accounting Session

1—Paper: *General Office Accounting*—Franklin Heydecke; 2—Paper: *Accounting for Depreciation*—H. M. Edwards; 3—Paper: *The Extent to Which a Tabulating Machine Can be Used in Accounting Work*—Wm. Schmidt, Jr.

THURSDAY, 2:30 P. M.

Third Commercial Session

1—Report of Committee on Residence Business—Clare N. Stannard; 2—Report of Committee on Electric Heating, Refrigeration and Kindred Appliance Sales—Frank H. Gale; 3—Report of Committee on Improved Wiring and Equipment Standards—M. C. Rypinski; 4—Report of Committee on Industrial Lighting—M. S. Sloan.

THURSDAY, 2:30 P. M.

Third Technical Session

1—Report of the Lamp Committee—W. F. Wells; 2—Report of the Committee on Prime Movers—I. E. Moultrop; 3—Report of the Committee on Electrical Apparatus—L. L. Elden; 4—Paper: *Ventilation of Turbo Generators*—R. B. Williamson; 5—Paper: *Progress and Development in Self-Cooled Transformers*—M. O. Troy.

FRIDAY, 10:00 A. M.

Second Power Transmission Session

1—Paper: *A New Method of Reducing the Investment in Central Station Boiler Plants*—H. A. Wagner; 2—Paper: *Determining Cost of Production in Steam Properties Under Varying Conditions*—G. H. Walbridge; 3—Topical Discussion on Operating Transmission Systems.

FRIDAY, 10:00 A. M.

Fourth Commercial Session

1—Report of Committee on Electric Signs—E. L. Callahan; 2—Report of Committee on Competitive Illuminants—H. J. Gille; 3—Report of Committee on Advertising—C. W. Lee; 4—Report of Committee on Functions of a Sales Department—T. I. Jones.

FRIDAY, 2:30 P. M.

Third General Session

1—Report of Committee on Rate Research—John F. Gilchrist; 2—Paper: *Elements Affecting the Fair Valuation of Plant and Property*—W. F. Wells; 3—Paper: *Some Reasons for Difference in Price for Different Services*—N. T. Wilcox; 4—Paper: *The Standardization of Electrical Selling*—Douglass Burnett; 5—Paper: *Economies in Operation Possible Through Time Study*—L. B. Webster; 6—Report of Committee on Memorials—T. C. Martin; 7—Report of Committee on Form of Section Organization—Frank W. Frueauff; 8—Vote on Constitutional Amendments; 9—Report of Nominating Committee; 10—Election of Officers; 11—Adjournment.

ENTERTAINMENT AT THE CONVENTION

The Entertainment Committee and its subcommittees, under the leadership of Mr. Arthur Williams as chairman, and Mr. Clarence L. Law, secretary, have worked out a complete programme for the entertainment of members and guests during the Convention week. It is impossible to give all the details here, and a separate programme embracing all the items will be issued on Monday, May 29. Meantime a vast amount of registration has been done of requests filed for tickets and accommodation in connection with the various events.

The Convention opens in reality with the reception at the Hotel Astor, on the evening of May 29, at 8.30, when there will also be an organ recital, a promenade concert on the roof in the Belvedere, and dancing. The grand ballroom has been secured as the centre of the festivities.

On Tuesday, during the day, a steamer will be provided for the ladies by the Brooklyn Edison Company, for the Hudson River; and in the evening the same boat will be available for out-of-town members and party for a trip down to Coney Island to see the wonderful lighting from the water. On Wednesday afternoon, at 3 p. m., the baseball game between the teams of the Brooklyn Edison and Philadelphia Electric companies will take place at Washington Park, Brooklyn. A silver cup to the winning team has been given by the Westinghouse Company. In the evening the Public Policy Report will be presented at the New Theatre, New York; and a special musical programme will be given by the fine orchestra of the theatre.

On Thursday morning the ladies will see the children's company in the miniature "Pomander Walk," and for the evening the Theatre Committee has secured three of the best theatres with popular plays or vaudeville. On Friday the ladies from out of town will be given an automobile ride in the morning, and there will also be an afternoon tea and concert at the Plaza Hotel. In the evening the Sons of Jove have a dinner at Coney Island.

On Saturday a steamboat will take the visitors on a trip around Manhattan Island, visiting central station points of interest. Lunch will be served on board and the party will land about 5.30 p. m.

For all of these features and events, subcommittees have been at work making provision for some weeks, and an elaborate series of circulars has been issued to the membership, giving the details and directions with the fullest care and minuteness. It may be added that golfers have also been provided for, and half a dozen metropolitan "crack" links thrown open, to which free entree and free transportation will be furnished.

An effort has been made by the various committees to notify all the members in advance by circular as to plans that are being carried out, but it will be readily understood that in some instances matters cannot be arranged until the last moment. The general and sub-committees are still very busily at work, and it is possible that even as this BULLETIN goes to press some further circular may have to be issued to the membership. As the great bulk of the membership is still in the region from Chicago eastward to New York, there is no reason, however, why every member should not be in receipt of the latest news before leaving home.

NEW MEMBERS

Class A: Harrison Electric Light & Ice Company, Harrison, Ark.; Clearwater Ice Factory, Clearwater, Fla.; Carrollton Electric Company, Carrollton, Ga.; Illinois Valley Gas & Electric Company, Streator, Ill.; Clinton Electric Light & Power Company, Clinton, Ind.; Grundy Center Electric Company, Grundy Center, Iowa; Worcester Suburban Electric Company, Uxbridge, Mass.; Northern Heating & Electric Company, St. Paul, Minn.; Exeter Electric Light & Power Company, Exeter, Nebr.; Minden Edison Light & Power Company, Minden, Nebr.; Richfield Springs Electric Light & Power Company, Richfield Springs, N. Y.; Alva Light & Power Company, Alva, Okla.; Peoples Ice & Light Company, Collinsville, Okla.; Sapulpa Electric Company, Sapulpa, Okla.; Oregon Power Company, Marshfield, Ore.; Clarion Electric Company, Clarion, Penn.; Darlington Light & Power Company, Darlington, S. C.; Sumter Lighting Company, Sumter, S. C.; Riverside Light & Power Company, Waynesboro, Va.

Class B: Mobile Electric Company, Mobile, Ala.—B. H. Clingerman, L. O. D'Oline, R. E. Flower, Theodore K. Jackson.

Montgomery Light and Water Power Company, Montgomery, Ala.—G. T. Coggswell, H. E. Donough, William T. Edmondson, C. W. Johnston, C. E. White.

Fort Smith Light and Traction Company, Fort Smith, Ark.—A. W. Crary, J. Walter Gellette.

Santa Barbara Gas and Electric Company, Santa Barbara, Cal.—C. W. Wilder.

Southern California Edison Company, Los Angeles, Cal.—Frank K. Balfour, W. L. Deimling, Paul J. Demmiger, W. L. Frost, T. A. Green, Walter M. McKnight, Edward H. Mulligan, M. R. Neelands, F. H. Percival, C. S. Walton.

Western States Gas and Electric Company, Stockton, Cal.—Henry E. Adams, W. W. S. Butler, H. L. Jackman, H. B. Kinney, W. A. Moody, J. H. Reuter.

The Denver Gas and Electric Company, Denver, Colo.—Roy C. Palmer, Chester A. Scott.

Savannah Electric Company, Savannah, Ga.—George J. Baldwin.

Northern Idaho and Montana Power Company, Sandpoint, Idaho.—Harry E. Morton.

H. M. Byllesby and Company, Chicago, Ill.—Alexander F. Douglass, J. F. McGuire.

Commonwealth Edison Company, Chicago, Ill.—James J. Adamson, Jr.; O. E. Ainswald, E. P. Anderson, Herbert A. Anderson, F. E. Ashton, H. C. Beecher, F. Bertsche, Oscar Biabout, A. Blumenthal, Harry Bradford, Walter Bruhn, Charles Nelson Buck, Edward A. Burman, E. J. Callahan, George R. Carlson, O. E. Carpenter, Frank J. Christian, Edward C. Clausius, Jr.; LeRoy Clivate, Harry Cullen, John J. Dixon, William Felty, Joseph Fritz, Henry Gercken, Ray Gibson, J. J. Gladstone, Harry W. Greiss, F. A. Groenke, A. E. Grunert, F. J. Guise, Francis Hagen, Harry A. Hallead, Charles H. Hartt, Harold L. Hayner J. C. Hilbert, J. T. Hoban, Harry R. Hokin, S. S. Hovey, Bertram Jenkins, J. M. Johns, Harry Jones, George L. Jorgensen, Frank J. Joy, Harold C. Joy, Harry J. Kafka, R. J. Kehoe, John Kennedy, John W. Kline, H. Klusman, Richard J. Kulleck, Arthur J. Leason, Emil Leyser, Carl G. Lueders, J. P. McArdle, Hugh I. McCormick, Elmer G. McDonnell, Michael F. McGovern, William G. McGraw, Albert L. McKanna, F. L. McKenna, Charles Maier, William J. Manning, H. M. Martin, Oscar Martins, Douglas S. Meaden, G. G. Merrill, F. F. Metcalf, L. H. Miller, William Mohring, Arthur Moldt, H. F. Neill, Max Nussbaum, J. A. O'Connell, Percy J. O'Hare, Martin J. O'Malley, William E. Perry, Richard Phillips, E. J. Pierce, John A. Pierce, W. F. Preussner, W. G. Printy, John B. Raisler, Clifford Reed, Ben Reinauer, Charles E. Robbins, Charles D. Rooney, Robert J. Sample, Adolf Scharf, V. H. Schmid, James C. Simpson, Michael F. Slapke, Harry P. Smith, George Irving Stanton, Walter E. Stofer, Fred Strube, L. Thilk, Maurice M. Thompson, J. Tiffin, J. H. Treadwell, Walter William Turner, Joseph N. Walton, G. R. Welch, R. H. White, F. C. Whitman, F. C. Wilhelm, C. H. Wrede.

Cosmopolitan Electric Company, Chicago, Ill.—Ira Hampton.

Federal Sign System, Chicago, Ill.—A. R. Gibbons, E. A. Lambrecht, Samuel I. Levy.

Minerallac Electric Company, Chicago, Ill.—H. S. Sines.

Scranton Electric Company, Scranton, Penn.—J. N. Arnow, Ambrose R. Barrett, Charles Berry, W. A. Burns, R. Buttner, A. L. Chase, C. S. Dawson, D. C. Dhain, Edward M. Dimmick, William R. Finch, John A. Fritz, Thomas Graham, E. R. Grant, Harry J. Hughes, Thomas H. Jones, James F. Loftus, Joseph L. McGurrin, C. W. Mellen, John F. Morrison, John B. Page, Gus B. Riedel, H. C. Sanders Harry H. Simmo, Edward A. Stalker, James F. Walsh, G. Rix Yard.

Woonsocket Electric Machine and Power Company, Woonsocket, R. I.—Robert C. Newcomb, Alfred S. Nichols.

Bristol Gas and Electric Company, Bristol, Tenn.—F. S. Koch, S. M. Vance.

Greenwood Advertising Company, Knoxville, Tenn.—E. B. Greenwood, N. V. Hibbard, W. H. Stewart, J. E. Tucker.

Utah Light and Railway Company, Salt Lake City, Utah.—Raymond E. Dresser, O. A. Philpott.

Newport News and Old Point Railway and Electric Company, Hampton, Va.—W. J. Payne.

Whatcom County Railway and Light Company, Bellingham, Wash.—Frederick Johnson.

Puget Sound International Railway and Power Company, Everett, Wash.—J. M. Wilmot.

Pacific Coast Power Company, Seattle, Wash.—Walter P. Elingwood.

Seattle Electric Company, Seattle, Wash.—H. M. Winter.

Beloit Water, Gas and Electric Company, Beloit, Wis.—C. B. Hillsbury, W. P. Lyons.

Equitable Electric Light Company, Lake Geneva, Wis.—J. S. Allen.

Madison Gas and Electric Company, Madison, Wis.—John St. John.

Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—Mortimer F. Flynn.

The Toronto Electric Light Company, Ltd., Toronto, Ont.—John R. Bibby, Archibald G. Milton, J. Teasdale.

Walkerville Light and Power Company, Walkerville, Ont.—J. W. Purull.

Montreal Light, Heat and Power Company, Montreal, Que.—A. H. Cleveland, W. O'Brine.

Class D: Hodgart and Company, Chicago, Ill.—Alexander Hodgart.

Interstate Electric Company, Ltd., New Orleans, La.

St. Louis Car Wheel Company, St. Louis, Mo.

Diehl Manufacturing Company, Elizabethport, N. J.

Vulcan Electric Heating Company, Buffalo, N. Y.

The Ansonia Brass and Copper Company, New York City.

Bishop Gutta-Percha Company, New York City.

The Ohio Brass Company, Mansfield, Ohio.

The Jefferson Glass Company, Follansbee, W. Va.

Electric Speedometer Company, Washington, D. C.

Class E: Benjamin Electric Manufacturing Company, Chicago, Ill.—George C. Knott, Walter D. Steele.

Minerallac Electric Company, Chicago, Ill.—C. C. Lovejoy, H. S. Sines.

Heine Safety Boiler Company, St. Louis, Mo.—J. C. Murphy.

Valentine Electric Sign Company, Atlantic City, N. J.—Thomas E. Valentine.

Westinghouse Lamp Company, Bloomfield, N. J.—T. G. Whaling.

Cooper-Hewitt Electric Company, Hoboken, N. J.—William A. D. Evans.

The Cutler-Hammer Manufacturing Company, New York City.—C. E Watrous.

General Electric Company, New York City.—J. D. Brooke, William Morgan Hand, Fred S. Hartman, J. M. Hayes, Robert S. Iremonger, J. M Hayes, A. M. Little, A. Carl Smith.

Holophane Company, New York City.—V. R. Lansingh.

Macbeth-Evans Glass Company, New York City.—Louis W. Young.

Selling Electricity, New York City—Earl E. Whitehorn.

Baker Motor Vehicle Company, Cleveland, Ohio.—Emil Gruenfeldt.

National Electric Lamp Association, Cleveland, Ohio.—William Coale, W. M. Skiff.

Columbus Buggy Company, Columbus, Ohio.—Louis J. Kaiser.

New York and Ohio Company, Warren, Ohio.—William R. Collins, Robert E. Gorton.

Electrical World, Philadelphia, Penn.—W. K. Beard.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Penn.—George C. Ewing, Stephen Gardner, R. H. Moore, Harold Whitmore Smith, W. B. Underwood.

NEWS OF THE SECTIONS

WHO GETS THE MEDAL?

The Doherty gold medal for the best paper read before a Company Section is to be awarded at the Annual Convention this month, and there is the most acute curiosity as to the winner. Chairman Eglin, of the Committee of Award, has a great faculty of reticence, and thus far has made no sign or intimation as to the winner, and it looks as though nobody—no outsider—would know anything about it until the actual moment arrives when the decision of the committee must be announced.

The Association office has been deluged meantime with inquiries, but cannot answer them. Its ignorance can hardly be described as blissful. Suppose we say, tortured!

THE COMPANY SECTION

The National Electric Light Association is growing rapidly in every direction, but in no field of its work has it expanded of late with such speed as in its Company Sections. These now embrace the great majority of the individual memberships, and as new Sections are formed by other companies coming into line, it is more than likely they will not only grow in numbers but increase in influence and usefulness. The coming Convention will afford a great opportunity for the study of the important problem of how to get the best results out of the Company Section. Here we have a new organ and a new engine, a new center for activity, a new focus for ability; and it is our duty to so develop the Section idea that it can be productive, in realization, of the utmost benefit to the Association, the Company, the Section and the individual member.

Considerable space is given on the Convention programme to Company Section work, and all the Sections have been invited to participate in the discussion at that time of questions connected with this important part of the Association's usefulness to the industry. As a matter of fact, few of the Sections, except through the BULLETIN, are acquainted with what the others are doing, but many of them are trying out new ideas or have made interesting experiments; and the Convention gives us all the chance to become more fully informed as to these points in development. Let us get together!

THE NEW YORK WELCOME

The remarkable growth of the New York Companies Section naturally excites comment and admiration. We had already in the Brooklyn Edison Company Section a vigorous branch with over 600 members, and now the newer body adds over 1300 more. No fewer than 2000 Company Section members welcome the Convention and the out-of-town delegates to Greater New York, and will aid the officers of the Association in the duties and hospitalities of the occasion.

Tesla Before the New York Companies Section

A meeting of the New York Companies Section was held in the Engineering Societies Building on Monday, May 15, at 8 P.M., when nearly 600 members of the Section and many ladies were present. The great attraction of the evening was an address by Nikola Tesla, who made his first appearance before the National Electric Light Association with a memorable lecture and demonstration at its annual convention in St. Louis in 1894. The address was practically a review of the researches and inventions of Mr. Tesla since that time, and covered a remarkably large field of work, including wireless telegraphy, wireless transmission of energy, the development of high-frequency apparatus, and the development and perfection of steam turbines, electric pumps and other apparatus. The lecture, which lasted about an hour, was profusely illustrated by lantern slides, and at the close Mr. Tesla showed in operation his highly ingenious new form of pump, operated by the adaptation of some of the new principles described. He was heard with deep attention and frequent applause.

The presiding officer of the evening was Mr. Arthur Williams, and Mr. Tesla was introduced by Mr. T. C. Martin. The chairman gave an account of the entertainment features which will attend the coming annual convention and impressed upon the members the fact that they were practically the hosts on this occasion and would have to assist in extending the hospitalities of the city to all visitors. It was stated that over 1300 members are now in the Section and that 1500 are expected by the time of the convention.

At the close of the more serious part of the evening's exercises, an excellent vaudeville performance was given and cigars were handed around. It was altogether a most memorable evening in the history of the Section.

Activity at San Antonio, Tex.

There has been considerable activity of late in the Company Section of the San Antonio Gas and Electric Company, and during the past two months several new members have joined. At the last meeting Mr. J. J. Wood, of the Fort Wayne Electric Works, and famous for many inventions in the field of electric light and power, gave an interesting address on developments in the field of aviation. He also described some of his early experiments and experiences with electricity.

Prof. Langsdorf Gives an Address in St. Louis

The regular monthly meeting of the Union Electric Light and Power Company Section, St. Louis, Mo., was held on April 28th before a large gathering of its members. Prof. A. S. Langsdorf, Dean of the Engineering Faculty of the Washington University, delivered an illustrated lecture on the oscillograph, which was followed with the greatest of interest. He discussed the history of the methods used to study the internal action of alternating-current machinery and referred to various instances where the study of the electromotive force and current curves, as given by the oscillograph, assisted in the detection of the causes of trouble with that type of machinery. After tracing the history and development of the various methods of obtaining the curves, he operated and described the oscillograph, which was on exhibition.

Curves of various types were shown on the screen, and after the lecture the members were allowed to examine the apparatus at close range, and some very interesting discussions were indulged in. During this time, the remainder of the audience were entertained by some splendid moving pictures of the principal waterfalls of the United States, some of the members thus getting their first lesson in conservation of energy and its waste from arrested utilization by government.

Using the Question Box

The nineteenth regular meeting of the Utah Light and Railway Company Section was held in the company's offices at Salt Lake City on April 25 at 8.20 P.M., Chairman W. M. Scott presiding. There were 12 members and two visitors present.

The Secretary was requested to prepare a synopsis of the year's work and forward it for use in the *Convention Daily* at the New York Convention.

Eight different questions from the March Question Box of the National BULLETIN were then answered by the members and discussed in open meeting. The exercise was exceedingly fruitful and instructive, and the topics covered a wide range.

The membership of the Section shows a gain of five per cent over last year.

Organizing at Scranton, Pa.

The Company Section of the Scranton Electric Company has now organized and promises to be at once large and useful. A meeting was held on the evening of Wednesday, April 26, when quite a royal time was had. There were already 15 unattached members of Class B connected with the company, and during the evening 26 more joined, making a total of 41. Mr. Duncan T. Campbell, the energetic and efficient manager of the company, who takes a keen interest in the movement, expects to see the membership brought up to 75 or 100 at an early date. Early visits to the Section are promised by Chairman H. H. Scott, of the National Membership Committee, and Secretary Martin.

The Section has now duly organized with officers, and the following is the list of those elected: President, Mr. Frank Howard; Vice-President, Mr. George Dewey; Secretary, Mr. Harry Hammond; Treasurer, Mr. Ely Harris.

Standardizing and Testing in Boston

A very interesting meeting of the Boston Edison Section was held on April 25, devoted to a discussion of the work of the Boston Edison Laboratory, the following papers being read: "Standardization," by Mr. S. R. Keyes; "Laboratory and Station Testing," by Mr. C. L. Kasson, and "Steam and Coal Testing," by Mr. R. E. Dillon. At the conclusion of the meeting a visit was made to the company's laboratory, where a number of high-tension experiments were performed and the equipment and methods of the department further explained. Mr. Keyes outlined the work performed by the standardizing division of the laboratory, discussing the equipment by which the accuracy of meters and instruments is tested, reviewing the advantages of the Clark and Weston cells as standards of potential and touching upon the value of standardized resistances. The company has adopted the Weston cell as its primary stand-

ard, on account of the low temperature-voltage coefficient, and one of four such cells is sent half-yearly to the Bureau of Standards at Washington for verification. The oldest of these cells has been in use nine years, and the voltage has dropped only 0.056 per cent. The resistances are also checked periodically. Weston laboratory instruments are used as secondary working standards, Kelvin electric balances and Siemens dynamometers also being employed. The company has three storage batteries for constant potential work and two precision series transformers. Extensive photometric work is also carried on by the department.

Mr. Kasson outlined the range of electrical testing handled by the laboratory, touching upon the instrumental comparisons, repair work on small apparatus, equipment and methods of testing employed. By means of transformers any current from zero to 1500 amp. may be obtained and any potential from zero to 75,000 volts. Among the articles tested regularly by the laboratory are watt-hour meters, instrument transformers, station shunts, indicating meters of various kinds, insulators, wires, switches, and samples of wood, asbestos, fiber, paper, rubber, marble and other materials. In addition to the foregoing lines of tests, special investigations are frequently made.

The station testing includes meter checking, relay or circuit-breaker testing and setting, battery testing and trouble work. There are about 2500 alternating-current and direct-current indicating and integrating switchboard meters in the generating plants and substations, these being tested according to a prearranged schedule, so that the cost shall be uniform per month. About 850 meters per month are calibrated under the present schedule. Secondary standards are used in the station work. All relays in the same group are tested so far as possible in the same month.

Occasional tests are also made of the station batteries. Tests of vehicle batteries have also been made, including tests on the vehicles themselves. Meter, transformer and wiring troubles are also investigated. In addition to the work in the laboratory and stations, the department does the electrical testing of cables and transmission lines. This work consists of high-potential, insulation and ohmic resistance tests, and tests of electrostatic capacity and electrolytic action.

Mr. Dillon described the methods of sampling coal for calorific and chemical tests, outlining the procedure of the laboratory in analyzing fuel. An important point brought out was an improved method of determining the amount of sulphur present in coal samples. The usual method, that of Eschka, requires about two days. The company has developed a method which enables the work to be done in about three hours, an important saving in view of the large amount of analytical work which has to be done yearly in connection with the fuel supply. The method consists of washing into a breaker the residue that is left in the bomb calorimeter after the heat-unit determination has been made, adding enough water to bring up the volume to 100 cu. cm. The solution is then filtered and barium chloride added, the result being a precipitation of barium sulphate. The solution containing the precipitate is then poured into an apparatus from which the percentage of sulphur in the sample can be read directly.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N Y.

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

CONTENTS

EDITORIALS

QUESTION BOX CLASSIFICATION

The Editor of the *Question Box*, when not attending sessions, may be found during the Convention at Association Headquarters, on the eighth floor of the Engineering Building, where he will be glad to meet and greet contributors.

Convention time is a good time to renew old acquaintanceships and make new ones. It is also an unusual opportunity for personal interchange of ideas and experiences. And good fellowship governs.

We have been good friends for a year—but apart. At Convention let us get together.

A bald-headed chap in our town publishes as an advertisement a picture of the back of his head, with the phrase underneath: "Meet me face to face."

Same here!

CENTRAL-STATION "EFFICIENCY ENGINEERING," AS DEVELOPED IN THE QUESTION BOX

Question 24—46 has called forth some significant replies.

This inquiry bears on a subject which has been rather freely and fully discussed of recent months, in print and from the platform, "the doctrine of efficiency or scientific management," and is to the effect that if in connection with the operation of industrial enterprises and railroads it is possible, by "scientific planning, that employes as individuals, and the organization as a whole, can accomplish more work with less expenditure of time and effort, thereby enabling individual wages to be increased and yet a saving effected to the corporation," is there not also an opportunity for similar evolution in the operation of electric light and power plants?

A reply to this inquiry, by Mr. L. B. Webster, relates in detail the results of an investigation into the percentage of time actually occupied by a number of employes in the operating and distribution departments of a central station, in doing their own work, in doing the work of cheaper men, and in doing nothing. Instead of publishing this in the *Question Box*, it was decided, in order to have the matter brought up where it would be likely to arouse an immediate and general discussion, to present it as a paper before the approaching convention, and under title "Economies in Operation Possible Through Time Study," this will be accordingly done at the third general session, on Friday, June 2.

Other replies refer to different phases of the subject. Mr. Parker of Rochester, for instance, is not much of a believer in "scientific management," as applied to any increase in the amount of concentration or actual working time demanded of an employe. He is convinced that by "tying employes too closely to the time clock, and keeping exact tabs on their movements while in the office," the effect of spontaneous and enthusiastic service is lost and disgruntled feelings follow. Mr. Parker would have every employe feel that he is working for a thoroughly "white" company, so that he may and will spread in the community the feeling that the central station is not a heartless

machine but a considerate and human organization worth working for and dealing with. The popularity and prestige thus gained is, he feels, worth more to a company than the additional routine or other work gained from an employe by the methods of a martinet.

He summarizes this idea in a paragraph: "The writer believes thoroughly in efficiency engineering when applied to standard production, but feels that public service corporation work demands a maximum of breadth consistent with definite efficiency on the part of each employe, since the relationships in which any employe will stand to the clientele of a public service corporation are so highly various in kind."

Mr. John F. Gilchrist of Chicago presents another and a thoroughly convincing and common-sensible phase of the subject. Says he: "There is no doubt in my mind but what intelligent and discriminating management, analyzing and studying all of the company's operations (which might be termed scientific management), could be of as great benefit to the electric lighting and power industry as to any other industry"; and suggests among the operations referred to: A consideration of the location and general arrangement and operation of generating stations; close examination into matters of line building; planning the placing of meters where they can be tested and read with the least possible expenditure of time; also such study of general company operations as will lead to eliminating duplication of work.

Mr. Gilchrist epitomizes his contribution in the following rather striking sentence: "I see no difference between the electric business and any other business with regard to what the application of brains and ordinary common sense may accomplish."

In this issue Mr. George W. Teffau, Jr., an engineer of the Willimantic Gas & Electric Light Company, returning to the question of efficiency in its relation to employes' time, in a short reply, varies the form of expression, and is the author of the following true and trenchant epigram: "Experience teaches that a workman's efficiency is in direct proportion to his satisfaction and ability, and in inverse proportion to poor conditions and poor leadership."

The matter is one of unusual interest and significance and is approachable from many directions.

The presentation of Mr. Webster's paper should call forth animated discussion, and may possibly result in suggestions calculated to increase the efficiency of central-station administration.

UNDERWRITERS' INSPECTIONS

Replies to a number of inquiries bearing on the subject of underwriters' inspections seem to disclose the fact that there is no standard practise in respect to such inspections, as they apply to communities of different sizes and localities. There are almost as many different methods as there are cities and towns.

The rules and procedure in communities of approximately the same size, even when under the jurisdiction of the same underwriters' association, vary widely. In some cases there is little or no inspection; in other cases the inspection is very loose; in others it is too stringent. Charges vary from nothing up.

Inspection conditions naturally have considerable influence on the quality and nature of construction. There is no doubt that underwriters' inspections, if carried out in the right spirit and with thoroughness tempered by good judgment, are of material advantage to the electric lighting industry, as a matter of fact have had much to do with raising the standard of construction in this country, particularly in the large cities, reducing the fire hazard to a negligible quantity, and helping instill into the public mind a well-founded confidence in the safety of electric service.

Co-operation between underwriters and central station on any fair and reasonable basis is highly desirable. It would seem, however, as if necessity for at least some rough classification of cities as to size and a standardization of underwriters' inspection methods, in accordance with such classification, might be advisable.

IS A WRITTEN CONTRACT ESSENTIAL?

An interesting question that came from the Far West and has received some interesting replies is number 22—51, which reads as follows:

"Do member companies consider it absolutely necessary to have a regularly executed contract with all customers before service is connected? The idea is this: Grocers, butchers, icemen, milkmen and other tradesmen regularly supply a service to householders, often amounting to several times the cost of the service we render each month, and this is done without a contract, application, or other written memoranda. Is the central station's business so different that it cannot be conducted on the same basis?"

A number of reasons for requiring a contract are given by correspondents, and the difference between the service supplied by a tradesman and by a public utility company is defined in various ways. What seems to us the principal distinction, however, is only indicated, and that perhaps not as clearly as might be or with adequate significance. While there are others, the main difference, as we see it, between the two transactions is that which exists between supplying a commodity, pure and simple, and supplying a service, as preliminary to or coincident with the sale of a commodity.

This difference between a commodity and a service was recently defined in a very clear and simple manner by Mr. Alex. J. Campbell, before the New London (Conn.) Board of Trade. He said:

"A commodity is usually sold at so much per unit. Some of the best examples are sugar, coal and flour. They are staple products; the demand for them does not fluctuate violently; they always have some value; and are easily handled and sold by the pound or ton. On the other hand, a service

may be defined as giving a person an opportunity to make use of something whether he actually uses it or not. For example, if a customer desires the convenience of electric light and the connections are made to his house, he is obtaining a service and should pay for it whether or not he uses any electricity."

An analogy illustrating the difference between the business of the grocer or the butcher and that of the electric lighting company, and indicating the reasonableness of requiring a written agreement for lighting or power service, is supplied by the contrast between a restaurant and a club.

One enters a restaurant when he pleases, buys a meal and pays for it. No written application is required or demanded.

The club, however, maintains a house with a steward; supplies light, heat, periodicals, dining-room and various other privileges to its members. This is distinctly a service, which is paid for in dues, whether it is used or not, and none but members may avail themselves of it. Before joining such an organization, it is necessary to make written application, subscribing to fixed conditions, just as with an electric service, and this application is accepted or rejected exactly as an application to a public service lighting company is accepted or rejected. Once accepted, a member may purchase, without additional contract, commodities in the form of meals, drinks, cigars, etc., for which he pays as "house charges," just as the subscriber to an electric service once connected, buys a commodity in the kilowatt-hours he may use through the medium of his equipment.

In other words, the more or less haphazard supply of a commodity requires no particular preliminary agreement, and each sale is a separate transaction apart from its predecessors, whereas the systematic and regular furnishing of a service is essentially a matter for special detailed advance arrangement, and naturally and properly the occasion of a written contract.

ANSWERS

MISCELLANEOUS

O—36. We are charged and pay a fee of $1 to the Fire Underwriters' Association for "inspection" of each new service we install; this separate from and in addition to the fee charged to the consumer for inspection of interior wiring and fixtures. Is this the custom in other large cities? Do the underwriters make a separate inspection of new services installed, and collect the inspection fee from the central station, as they do in our case?

George H. Whitfield, General Superintendent Light and Power, Virginia Railway and Power Company, Richmond, Virginia.—The Southeastern Underwriters' Association, under whose jurisdiction we come, have agreed to accept the inspection reports of our local city inspectors, and no charge is therefore made for the inspections necessary to permits for new services. At one

time they became dissatisfied with the local inspections, and threatened to put on an inspector of their own, and charge for his services, but as the character of the work done by the local inspector was improved, and additional inspectors provided by the city, this threat was never carried out. An official inspector of the Underwriters' Association frequently assists the local city inspector, but no charge is made for such assistance.

E. A. Barrows, Treasurer, Narragansett Electric Lighting Company, Providence, R. I.—In this city there is no fee for inspection, the fire underwriters doing this at their own expense, and in suburban districts inspection being made by this company at our own expense.

Douglass Burnett, Manager, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—The Underwriters of this city do not make it a practise of making a separate inspection of new services installed, but if requested to make inspection, the fee is $2.50. The only inspection made by the Underwriters are those which they consider special. The wiring and fixtures are inspected in this city by the building inspectors, and no fee is charged the customer, nor the company. Underwriters' office is furnished with daily lists of all connections made so that inspectors and agents may attend to the cases in the manner they think best.

O. M. Rau, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—There is no inspection charge made in this city by the Fire Underwriters' Association. The inspection is made by the local representatives of the Underwriters' Association, in the interest of the insurance carried by the customer, but no fee is paid either by the customer or by the central station.

There is, however, an ordinance at present being prepared, the intention of which is to establish a city inspector who is to pass on all electric installations, for which inspection a fee will be charged on a sliding scale according to the size and capacity of the installation. The Underwriters' Association is at present not favorable to the appointment of such an inspector.

O. H. Hutchings, The Dayton Lighting Company, Dayton, Ohio.—Locally, we are not asked to pay for an inspection of our new services. We would strenuously object should we be asked to pay a similar fee to that noted by the interrogator.

All electrical inspections in this territory are made by representatives of the Ohio Inspection Bureau, who maintain branch offices in the larger cities of the state. Their inspection fee is determined by the size and nature of the installation, but their schedule of fees is very reasonable, and the expense of the entire inspection is borne by the property owner or lessee, as it should be.

A. D. Spencer, The Edison Illuminating Company of Detroit.—In Detroit inspection of interior wiring, fixtures, etc., is done by the Public Lighting Commission, a municipal board which operates the public lighting system, and whose duties have been extended to cover inspection of wiring, etc.

The fee, which varies with the size of the installation, is paid by the person applying for the permit to do the wiring. No charge is made against the lighting company.

The Underwriters accept the city certificate and do not make any further inspection.

Mr. A. A. Pope, New York.—The schedule charges of The New York Board of Fire Underwriters, for inspection of electric light and power installations, includes the following sub-divisions:

Complete equipment, not including service connections.
Wiring to outlets.
Fixtures.
Additional extensions or changes.
Source of supply.
Temporary work.
Duplicate certificates.

It is their practise to charge a fee for each sub-division to the party making the application for inspection, which may be either the electrical contractor installing a complete equipment, or a number of separate contrac-

tors who are furnishing a separate part of the equipment, such as the elevator motor and its wiring, the fixtures, etc.

The source of supply may be either a generator or a service connection of the central station. The contractor would not be expected to apply for inspection of a portion of the work over which he has no responsibility. It seems, therefore, that the company installing the service should ask for the inspection and pay for it. The fee for the inspection of the service is 50 cents, for generators of 25-kilowatt capacity or less $1.50, for generators of over 25-kilowatt capacity $2. The feeling of the companies and others in New York City who pay the underwriter's fee is that it is intended to cover the cost of maintaining a system of inspection by the insurance authorities.

Paul F. Williams, Assistant Engineer of Distribution, The Commonwealth Edison Company, Chicago, Ill.—In Chicago there is no charge made by the Fire Underwriters' Association for inspection. All interior wiring is inspected by the City Electrical Inspection Department and the bill is rendered either to the contractor making the installation, or to the consumer, according to previous contract agreement. This is paid by either of these two parties before the service is installed. Generally speaking, the underwriters make no inspections, but accept the inspection of the City Electrical Inspection Department as their inspection.

C. A. Dean, Head Installation Department, Cambridge Electric Light Company, Cambridge, Mass.—All new installations are inspected by city electrician, for which there is no charge made to either customer or company. The inspector issues permit to company for service connection. Population of Cambridge is about 105,000.

Allegheny County Light Company Section, Pittsburgh, Pa.—In Pittsburgh, the bureau of electricity makes an inspection of each service installed, combining this inspection with that of customer's wiring and fixtures. No fee is charged either the customer or the central station for this inspection, which is accepted by the Board of Fire Underwriters as final. The Board of Fire Underwriters will make a separate inspection if requested to do so, charging a fee of from $1 upward, varying with the size and character of the installation. This fee is paid by the party requesting the inspection. The Board of Fire Underwriters inspects about 8 per cent of the services installed in the city.

BOILERS, ENGINES, TURBINES

3—S. Will engineers of large central-station systems who are using the "dry tube" surface condensers (mentioned in the Proceedings of the National Electric Light Association, of 1909, page 105) give information concerning same as to whether any drawbacks have been encountered since they were installed, whether they are actually giving the results that were mentioned in connection with the article quoted, and whether higher vacuum can be maintained by this condenser under similar conditions than with the standard condenser without the dry tube addition.

Wheeler Condenser and Engineering Company, George D. Atwood, Manager New York Office, New York.—We are perhaps not in position to answer this inquiry as operating engineers, but there is no question but that these condensers are a great improvement on the old style of surface condensers. The old style is a shell packed full of tubes, through which such of the entering steam as is not condensed on the top row of tubes must worm its way down through the succeeding rows of tubes until it comes in contact with condensing surface; thus, a large portion of the steam does not come in contact with condensing surface, until it has forced its way down to some point between centre or bottom of condenser. This causes a certain amount of back pressure, which is, in other words, a loss in vacuum. In these condensers the water condensed on the upper tubes drips down over the lower tubes, so that, aside from the loss in condensation due to this film of water over the tubes, considerable energy is wasted in cooling the water of condensation.

In the so-called "dry tube" condenser large passages are left, so that the entering steam meets with the cooling surface without obstruction. The tubes are arranged in small banks, under each bank being a baffle plate which carries the water of condensation to the side of the shell, so that the condensate comes from the condenser at a temperature very near to the temperature of the condenser.

The reader should understand that with a "dry tube" condenser the condensation per square foot at any point is no greater than the maximum condensation per square foot at the most efficient point of the old type condenser, but the average condensation per square foot is very much greater in the "dry tube," as nearly all the surface is working at the point of maximum efficiency all the time.

5—8. Has there ever been a satisfactory solution for scale in boilers in a plant running noncondensing and using very hard water? If so, what is it?

(Also answered in February and March BULLETINS.)

George W. Steele, Manager, The Lehigh and Northampton Light, Heat and Power Company, Catasauqua, Pa.—I would recommend you to communicate with Mr. Horace Evans, No. 1421 Arch Street, Philadelphia, Pennsylvania, on this matter, as he has the best material we know of for overcoming the trouble of scale or *oil* in boilers.

I speak from experience, as we have been using it for over two years at both our electric and gas plants. At our electric plant, we have installed the following boilers:—

1 — 300 hp	water	tubular	boiler —	Maxim.
1 — 300 hp	"	"	"	Stirling.
1 — 100 hp	"	"	"	Erie City.

and are running this plant, condensing.

We have a 100 horse-power boiler at our gas plant, running non-condensing. The compound has been used for the past two years and find the scale has disappeared and we have practically eliminated the replacing of tubes. We use on an average 2½ pounds of boiler compound, per 100 horse-power, every 24 hours, same costing us on an average of $14 per month.

Our water supply is taken from a canal and is very bad, being largely impregnated with lime and sulphur. I don't see how any condition could be much worse than ours before we found the solution to our trouble.

5—11. Will member companies please give us their experience in operating boilers under the following conditions: Our boilers are set to blow off at 125 pounds pressure, and this is the pressure carried through the peak of the load. After midnight when the load is light, and during the day, it is the custom of our firemen to allow the steam to fall to about 80 or 90 pounds. Is it or is it not more economical for us to hold the pressure at 125 pounds all the time?

(Also answered in April BULLETIN.)

I. E. Powell, Rochester, N. Y.—Between peaks, when the engine equipment is standing idle and the principal load on the boiler room is to supply the constant losses of the plant with probably some steam heating, it is more economical to allow the steam pressure to fall, as you are doing. The temperature of the boiler and piping system is lowered, which decreases the radiation losses, and by lowering the temperature of the boiler its efficiency for absorbing heat from the furnace is improved.

GENERATORS, CONVERTERS, SWITCHBOARDS INSTRUMENTS

10—44. What effect has power factor on efficiency of generators, distribution, motors?

P. M. Lincoln, Electrical Engineer, Pittsburg, Pa.—A reduction of power factor below 100 per cent, whether the reduction be from a leading phase angle or a lagging phase angle, will cause a larger current to flow to give a certain amount of true energy than would be the case if the power factor were 100

per cent. The effect of this larger current will be in general to decrease efficiency, since the copper losses will be increased on account of the larger current necessary.

When considering distribution losses, the amount of this increase is easily calculable. For instance, if we have a condition where the distribution or transmission loss is 10 per cent at 100 per cent power factor, it is easy to calculate what will be the loss if the same power is transmitted at 80 per cent power factor. The actual transmission or distribution losses will be increased in proportion to the square of 100 to the square of 80 and the efficiency in this case will therefore be decreased from 90 per cent to 85.3 per cent. This follows from the fact that the copper losses have increased from 10 per cent to 15.6 per cent and the equation for efficiency instead of being 90 ÷ 90 + 10 now becomes 90 ÷ 90 + 15.6.

The following is a table showing the reduction in efficiency when assuming efficiencies at 100 per cent power-factor for certain stated reductions in power-factor:

Power Factor	Efficiencies						
100	98	96	94	92	90	85	80
95	97.8	95.6	93.4	91.1	88.9	84.4	78.2
90	97.5	95.1	92.6	90.2	87.8	82.1	76.4
85	97.2	94.5	91.8	89.2	86.7	80.3	74.4
80	96.9	93.8	90.8	88.0	85.3	78.3	71.9
75	96.4	93.0	89.7	86.5	83.5	76.1	69.3
70	95.9	92.0	88.5	85.0	81.5	73.6	66.2
60	94.6	89.6	85.0	80.5	76.5	67.2	59.0
50	92.4	85.6	79.6	74.2	69.2	58.6	50.0

When considering generators and motors the same laws apply as when considering distribution. In general, a reduction in power factor means a reduction in efficiency owing to the increased copper losses. However, in the case of generators and motors the reduction is not so great as in the case of distribution and transmission. In distribution and transmission all of the losses involved are copper losses and consequently the increase due to the reduction of power factor affects the entire loss. In generators and motors, the copper loss is usually a comparatively small proportion of the total loss. The reduction in power factor affects the copper loss only and has no affect whatever upon iron losses, friction and windage losses, etc. As a result, the efficiencies of motors and generators are not so much affected by the reduction in power factor as transmissions and distributions. When considering the copper losses of generators and motors, the table given above will apply just as exactly as when considering transmission and distribution losses, and the actual reduction in efficiency can be obtained by increasing the copper losses of the machine in question in the ratio shown in the above table and then making from this data a new determination of the efficiency.

This will not include modification in the field current losses of synchronous apparatus. The modification in power factor changes the field current as well as the armature current. The amount of this modification depends entirely upon the design of the machine and no simple law can be laid down for its determination.

In general, however, a lagging power factor will increase the field copper loss and a leading power factor will decrease it. In the armature losses, there will be an increase no matter whether the power factor becomes leading or lagging.

R. M. Stevenson, Brooklyn.—Low power-factor lowers the efficiency and reduces the capacity of all electrical apparatus. It also impairs the regulation of the system.

A. G. Rakestraw, Contract Agent, Harrisburg Light, Heat and Power Company, Harrisburg, Pa.—The reduction of power-factor reduces efficiency of generation and distribution proportionately, because if the current is thrown out of phase with the impressed voltage, the heat losses will be increased in

proportion to the amount of power generated or transmitted. The power-factor of the system has no bearing on motor efficiency because each motor or other piece of apparatus determines the power-factor of the current which it draws independently of conditions in the system. However, high power-factor in motor design helps in producing an efficient machine, as it tends towards the reduction of copper losses.

10—45. At a certain station the equipment is loaded to the limit the greater part of the day, and at times the equipment is inadequate to supply the peak loads which are not only momentary. The generators are driven by steam engines. Which would be the more economical and efficient to make up this deficiency, to install a synchronous motor, or an induction generator connected to an exhaust turbine? The latter, of course, would run idle except during heavy load periods when the maximum exhaust steam is delivered to turbine and runs same as an induction generator.

Edwin D. Dreyfus, Commercial Engineer, The Westinghouse Machine Company, East Pittsburgh, Pa.—From the partial clue given, the problem would appear to center more about the character of the low pressure turbine installation than of the type of generator to be attached to it. There should be little reason to propose a scheme where the low pressure turbine runs idly during all periods except peak load hours. If the plant is of sufficient size, it should also be employed to improve the economy throughout the whole day.

One very important feature of the low pressure turbine combined with the reciprocating engine is the quite uniform steam consumption obtaining over a wide range in load, and providing at the same time a generous overload capacity, depending upon the nature of the steam valves on the engines.

It should not be overlooked that it becomes a debt item to "float" the low pressure turbine on the line the greater part of the time, and very probably this method would complicate the governing system. However, I would infer that the situation would prove a good case for the low pressure turbine, to be operated constantly and preferably without a governor. Synchronous generators are almost always used for this work.

H. G. Stott, Superintendent Motive Power, Interborough Rapid Transit Company, New York.—This question does not state what the power factor of this system is, but usually in traction systems operating rotary converters the power factor is in excess of 90 per cent; so that little, if anything, could be gained by the addition of a synchronous motor. An induction generator coupled to an exhaust turbine, however, would improve the economy of the plant at all times. There would be no object whatever in running it idle during light loads as it would be equally serviceable in improving the economy of the plant on either light or heavy loads. Before deciding to install an induction generator, it would be necessary to consider whether there is enough reserve field capacity in the present generators to excite the induction generator. In case they do not have a sufficient margin for this purpose it would be advisable to install a synchronous generator coupled to the exhaust turbine.

C. W. Stone, Consulting Engineer, General Electric Company, Schenectady, N. Y.—My understanding of this question is that as the apparatus is fully loaded it will be necessary to supply some new apparatus to carry the peak load. If this is the correct understanding my answer would be that it is probable that the cheapest way to obtain this additional capacity would be to install some low pressure turbines, running these from the exhaust steam coming from the engines. Of course, this is based on the understanding that the engines are in good condition and that plenty of condenser water is available. Unless the station is a large one, it is quite probable that it might be advisable to make these low pressure turbines of the mixed pressure type, so that they could be used as fairly efficient units in case of failure of one of the engines. I do not understand the use of the synchronous motor. As it is possible that the day load is really not all energy load, but is partly low power factor load, in this case a synchronous motor could be used as a rotary condenser to better the power factor, and thus reduce the apparent load on the generator. Of course, if this is the case, there would be no object in the installation of the low pressure turbine.

Arthur H. Ford, Consulting Engineer, Iowa City, Iowa.—It is probable that the preferable unit to install would be an exhaust steam turbine connected to an induction generator. This is because the exhaust steam turbine could be so proportioned that it would utilize all the exhaust steam, it would require no governor, except a stop governor to keep it from running away in an emergency, and it would require a simpler switchboard panel than a synchronous generator.

OVERHEAD AND UNDERGROUND LINES

12—43. What do member companies consider the maximum length of common secondary desirable? Is each case figured on a certain allowable voltage drop basis or is there an arbitrary limit as to length? What size wire is used for same and how is size determined? Are transformers operated in parallel, feeding different points on the same secondary?

(Also answered in April BULLETIN.)

S. J. Lisberger, Engineer Electrical Distribution, Pacific Gas and Electric Company, San Francisco, Cal.—The maximum length of common secondary desirable is a very variable quantity. It is the practise of this company to figure a certain allowable voltage drop, there being no arbitrary limit as to its length. The size and length of the secondary wire will vary largely according to the class of business supplied. In a district which is covered by many large apartment houses the size of secondary is very much different than that in a residence district where the load is not heavy and the houses widely scattered. We figure our secondary on the basis of certain allowable drop, which rarely exceeds 3 per cent from the transformer to the last service. Transformers are operated in bank; the number on the bank, however, rarely exceeds four.

M. Webb Offutt, General Manager, Schenectady Illuminating Company, Schenectady, N. Y.—This company has gone to the limit in the use of common secondary. Several feeders, both overhead and underground, have their entire secondary connected in common. Transformers feeding different points, necessarily operating parallel, the load on these feeders is fairly well concentrated and does not cover a very large territory. In places where the load is scattered, each case is taken up separately and is decided by the existing conditions. We have no arbitrary limit as to the length of secondary, but the length and size of wire is determined by the voltage drop, the balance and losses in transformer, the cost of investment against line losses and cost of investment.

Woonsocket Electric Machine and Power Company, Woonsocket, R. I.—We believe that the length and size of secondaries should be such that, with the transformer operating under full load conditions, it will give not greater than two per cent drop at such points in the secondaries that are farthest from the transformer. Only such services that would require larger than No. 6 wire are figured as to length and size. We operate transformers in parallel feeding onto different points on the same circuit. Particular pains are taken to have copper between said transformers of sufficient size to carry the full load on the largest transformer.

12—44. Is it considered good practise to install a 50-kilowatt transformer on a single pole? Is it advisable to reinforce the base of a pole carrying heavy transformers with concrete?

(Also answered in April BULLETIN.)

The Nevada-California Power Company, George M. Wills, Superintendent, Goldfield, Nevada.—The Nevada-California Power Company have made it a practise of installing all 30-kilowatt transformers and larger sizes upon a platform supported by two poles. We have also adopted the practise of reinforcing all our transformer poles with reinforced concrete. This tends to preserve the pole as well as strengthen it.

M. Webb Offutt, General Manager, Schenectady Illuminating Company, Schenectady, N. Y.—This company does not install pole-type transformers larger than 30 kilowatts. If the load is concentrated at one point and requires more than 30 kilowatts, we prefer to place another transformer on the next pole and use common secondary between the two transformers. Where we use two or three large transformers for a motor installation, we place them on a platform between two poles set close together. This construction is safer and less expensive to maintain. We have not found it necessary to concrete the base of poles carrying transformers.

J. T. Day, Superintendent, Malden Electric Company, Malden, Mass.—We do not consider it good practise to install 50-kilowatt transformers on single poles, and where we find it necessary to do so, we use a separate pole from our main line pole set in concrete. We consider it advisable to reinforce the base of all poles carrying heavy transformers, or in fact, all poles that are subject to a heavy strain, in concrete.

W. L. Sees, General Foreman, Commonwealth Edison Company, Chicago, Ill.—Yes. We have a number of such installations. Not as a rule, but pole should be under-braced if there are services leading away from same.

Geo. W. Teffeau, Jr., Engineer, The Willimantic Gas and Electric Light Company, Willimantic, Conn.—No. A 50-kilowatt transformer weighs approximately 1700 pounds, which is an abnormal weight for a standard pole to carry when wind-sway is considered.

12—45. This company has been supplying 220-volt service from our lighting network to operate a 2½-kilowatt wireless telegraph outfit. Our system is overhead, 2200-volt primary, 110-220-volt secondary, transformers banked, neutral grounded. When the outfit was operated, considerable trouble was experienced on the consumer's premises in the immediate neighborhood, due to the breaking down of lamps, sockets, and insulating joints, and to meter stoppages.

Was this trouble caused by our overhead wires acting as receiver circuits, or was it due to a "kick-back" through the step-up transformer of the outfit, or to some other cause?

What can be done to remedy the trouble?

We would appreciate any information from companies supplying service to this class of business, regarding kind of service supplied, method of supplying same, trouble experienced, and methods of remedying same.

(Also answered in April BULLETIN.)

S. J. Lisberger, Engineer Electrical Distribution, Pacific Gas and Electric Company, San Francisco, Cal.—This company has experienced considerable trouble from wireless apparatus, with results practically the same as mentioned in the question. In quite a few cases trouble has been caused by a kick-back through the step-up transformers. Much depends upon the type of wireless apparatus being used by the individual operators. Whenever we get a particularly troublesome case we disconnect the consumer when he will not rectify the trouble. Our practise has been to install in certain cases individual transformers on wireless stations, and in quite a few cases the customer has used a small motor-generator set, which eliminates the trouble.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—We have several wireless telegraph outfits on our lines, and our system from which these are supplied is the same as that of member company making inquiry. We have experienced no trouble, with one exception. In this case there was a "sending" outfit of about 2 kilowatts capacity, and in several instances the fixture wires were burned off and insulation joints punctured in adjacent suite of same building. On inspecting the installation we found the condenser was grounded to gas pipe, and ordered this changed to water pipe, but as trouble continued, we notified customer operating apparatus that we would install a separate transformer, meter, etc., making an additional minimum charge for same. This we did and have had no further complaint from customers in the same locality. We inspect all installations of wireless apparatus before making connections and believe that those of small capacity will cause no trouble if line and meter are protected by a condenser of suitable type and properly grounded.

12—46. (a) Have member companies experienced trouble from the wireless telegraph stations affecting their lighting lines?

(b) If so, what protective devices are used and what are your requirements before you will accept a wireless station on your lines?

(c) Have you found cases where these wireless stations were installed on your lines without your knowledge of same; and if so, what action have you taken?

(d) Do you require separate service, separate transformer, and separate meter for each installation? If so, do you bill the consumer at the regular lighting rate? Do you make any charge for connection?

R. M. Stevenson, Brooklyn.—(a) There are several wireless stations at present in operation on our lines, but we are not experiencing any trouble.

(b) No protective devices are demanded, but wireless companies usually install them for their own protection. The apparatus, if over 1 kilowatt, must be wound for 230 volts.

(c) Wireless equipments have been added to existing installations without notice to the company, but no action was deemed necessary.

(d) We install a separate meter and sign upon our regular retail power contract.

(Also, see answers to Question 12—45 in April and May BULLETINS.)

12—47. If all the station output of single-phase, 2300-volt, 60-cycle current for incandescent lighting is metered at the station and all the customers are on meters, in a town of 5000, what proportion exists in actual practise, between the total consumption as indicated by the customers' meters and the total output of the station as indicated by the station meter? In general, what per cent of the loss is chargeable to line, transformers, meters—what else?

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—Percentage of unaccounted-for current in well-managed plants should vary from 15 to 25 per cent. This will vary on different plants, depending on condition and size of lines, number and size of transformers, number of meters and attention paid to their accuracy. A large number of small or old-type transformers will tend to increase losses, and if customers' meters are not kept in adjustment, losses are apt to increase. If lines are not protected through trees, leakage at such points will also increase losses. If losses exceed 25 per cent, it is a fair indication that the system generally needs attention, and such investigation will usually show where losses can be reduced.

The percentage unaccounted for in the Gardner Electric Light Company for the calendar year of 1910 was 21.9. We hope to reduce this materially during the coming year.

H. Clyde Parrish, Superintendent, Great Barrington Electric Light Company, Great Barrington, Mass.—For the past three years our meters show a loss of 22½ per cent. This is chargeable to line losses, transformer and meter losses. Our customers are all metered except about ten, which do not average over $1 per month and which we estimate as using 75 kilowatts per year each, this being added to the total as shown by meters.

John G. Learned, General Contract Agent, North Shore Electric Company, Chicago, Ill.—In one of our districts the loss for the last fiscal year was 23 per cent, between substation and customer meters. This is exclusive of street lighting. A town of 5000 might average 30 per cent.

C. C. Hellmers, Maryville Electric Light and Power Company, Maryville, Mo.—We have no data previous to the month of April, and have always figured about 250 kilowatt-hours per day as transformer, meter and line loss. Last month, April, our total output was 35,845 kilowatt-hours, our street lights (52 arcs and 65 series Mazdas) consumed 10,662 kilowatt-hours and customers' meters account for 14,828 kilowatt-hours, leaving 10,355 kilowatt-hours unaccounted for, except as line, transformer or meter loss. Of course there were a few meters which were not read and we also have a few flat-rate customers mostly using one 16-candle-power lamp. The whole would amount to the equivalent of forty 16-candle-power lamps.

Our circuit is three-phase, sixty-cycle, and we have more transformers than necessary, but we are cutting the number down, using larger wire and three-wire distribution.

12—48. We operate two 11,000-volt transmission lines, each approximately fifteen miles long. Near the end of each line a tap-off is made to supply large customers with power. Will member companies please advise what method they take to make high potential line tests on their transmission lines; also how they locate grounds or open circuits on such transmission lines?

(Replies to Question 11—11 in October and November, 1910, BULLETINS, also apply to this Inquiry.)

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—Good practise demands periodic inspection of transmission lines, which will in very great measure prevent grounds and anticipate other difficulties. On 11,000-volt lines, electrostatic ground detectors will at once indicate the presence of a ground on the lines of an average system and inspection of line will locate the difficulty. Apparatus has been designed for locating troubles with a fair degree of accuracy and are on use on many transmission systems. (Would suggest looking up apparatus designed by Mr. Nicholson, of the Niagara, Lockport and Ontario Company.)

L. L. Elden, Boston, Mass.—Taps from transmission lines of this character are made through oil switches, located on poles in the overhead system and in manholes in the underground system. When high-potential tests are to be made on any portion of the line, suitable switches are opened to clear other parts of the line which are not to be subjected to test. High-potential tests are applied either directly from a separate generator or from a high-potential set used regularly for that purpose.

Grounds on transmission lines are indicated at the station by means of ground detectors, either of the static or the Torchio types of detectors now generally in use.

Open circuits on transmission lines, particularly in the overhead system, are indicated by the reading of the instruments in generating or sub-stations, it being our custom to provide instruments for each phase in order that this may be determined.

L. E. Imlay, Superintendent, The Niagara Falls Power Company, Niagara Falls, N. Y.—If each conductor of a transmission line is provided with a ground detector and an ammeter they will be of great assistance in locating trouble. In order to locate a ground where wooden poles are used, probably the best method is to separate the defective line from the rest of the system and, with a separate generator, keep potential on it while a patrol is made. If the trouble is due to a defective insulator, the pole, pin and cross-arm, if all are made of wood, will probably be found on fire.

If the ground is due to some other cause, keeping potential on a line will probably burn it off at point of contact. Grounds from other causes than defective insulators are very rare.

Where steel poles are used a ground generally develops from breakdown of insulators and the resistance of the ground is so low that the conductor frequently burns off before potential can be taken off the line. If, however, the conductor is not burned off the trouble can usually be located with great accuracy by a Murray loop test.

It is good practise when resuming service after repairs have been made to bring potential up gradually on a separate generator. This method should also be used when resuming service after an interruption caused by lightning. After repairs on a transmission line where steel poles are used, before applying potential from the generators, the conductor should be given an insulation test to ground at double potential with a transformer of ample capacity to supply the charging current of the line. The conductor on which an open circuit occurs can be located by referring to the ammeter with which the conductor is provided. The location of the break can best be determined by patrolling the lines.

Herbert A. Wagner, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—We operate several overhead transmission lines at 13,000 volts the longest being about six miles. We make no ground tests whatever on

these lines, and depend upon patrolling to locate any faults. We also take a large amount of power over a 45-mile transmission line at 66,000 volts. This line before being put into service was tested at about 85,000 volts, but has not been tested since. The line is divided into four sections, and in case of trouble the sections are cut out, one by one, beginning at the furthest from the power station until the trouble is definitely located in one of the sections. The fault is then found by patrolling. We have found no satisfactory way to accurately locate grounds or open circuits on such transmission lines other than by actual inspection.

H. B. Vincent, Superintendent, Niagara, Lockport and Ontario Power Company, Rochester, N. Y.—Our 60,000-volt lines are operated with the neutral of the transformers grounded through resistance.

We locate grounds by the method described by L. C. Nicholson in a paper entitled, "Location of Broken Insulators and Other Transmission Line Troubles," presented at the 24th Annual Convention of the A. I. E. E., Niagara Falls, New York, June 26th, 1907.

We have been using this method for four years and find it very successful. Although we have no method of locating open circuits the above test enables us to know immediately should the line be open.

This method of testing has never been applied to lines using ungrounded wooden pins. On our 11,000-volt system, which is ungrounded, we have experienced no trouble due to broken insulators, and have not found it necessary to make location tests.

Harry M. Hope, Stone & Webster Engineering Corporation, Boston, Mass.—
1. High potential tests on transmission lines are ordinarily made with the working voltage.

2. Grounds and open circuits are located by inspection either with current on or off according to circumstances.

3. Where loads tapped off of long lines interefere with testing, the lines are sometimes sectionalized at or on each side of the point where loads are tapped off. Disconnecting switches of open-air type are often used for this purpose.

Allegheny County Light Company Section, Pittsburgh, Pa.—We find the best results are obtained by patrolling transmission lines daily. If daily inspection is not possible, an inspection should be made at least once a week. By this method defects are discovered before they manifest themselves as grounds or open circuits. The use of a field glass has been found by some of our men to be of special use in making specific inspections, thus avoiding the climbing of poles.

R. M. Wilson, General Superintendent and Chief Engineer, The Montreal Light, Heat and Power Company, Montreal, Canada.—I beg to state that we have a number of 11,000-volt transmission lines from which are supplied several power customers. We have not had any difficulty in operating these lines as same are equipped with suitable protection devices and also proper ground detectors. We have had very little trouble with the operation of these lines, and our experience has been that as soon as trouble occurs on one of the lines we very soon hear of same by having the customer calling in advising that he has not any power, or we hear of it by having our automatic switches open. In order to prevent trouble occurring on these lines, we make weekly inspection of each and every line and thorough examination of all poles, wires, crossarms and insulators to see that everything is in proper order. These inspections have been the means of preventing a great deal of trouble on the lines.

12—49. Do member companies find it practicable to have linemen's hatchets equipped with a leather thong or rope to slip over lineman's wrist while he is using hatchet at work on pole above ground, in order to prevent injury to persons on ground should hatchet slip from his hand?

J. B. Martin, Superintendent Line Construction, Malden Electric Company, Malden, Mass.—I don't think it would be practicable for the linemen to use straps on their hatchets inasmuch as the strap would be inconvenient to them in working on poles where they are obliged to change from one side to the other. The better plan, in my opinion, would be to have a snap hook

attached to the handle of the hatchet so that they might hook it to their safety belts, as there seems to be a great danger in dropping the hatchet from the belt rather than out of the hand.

W. L. Sees, General Foreman, South District, The Commonwealth Edison Company, Chicago, Ill.—We have not found it necessary to have linemen's hatchets equipped with leather thong. The accidents which have occurred from this cause are very few.

We have, however, found it to be a great advantage to have each gang equipped with tool bags, so that tools may be sent up pole to linemen in bag, and the bag is allowed to hang on pin or cross-arm while the man is working on the pole, so that he may place tools that are not in use in the bag and not take chances of having them knocked off of pole or wires and falling to the ground.

13—14. With what success has lead-covered, steel-armored cable been used in underground construction for series street lighting systems, especially on alternating current systems?

(Also answered in March BULLETIN.)

Robert S. Stewart, Consulting Electrical Engineer, Detroit, Mich.—I have had no experience with lead-covered steel-armored cable in underground construction for series street lighting systems. Our experience with lead-covered cable drawn into conduits has been satisfactory for series street lighting systems, both alternating current and direct current, and I believe that if the service warrants underground construction it would justify the additional expense of conduits.

Standard Underground Cable Co., Charles W. Davis, General Superintendent of Construction, Pittsburgh, Pa.—While we have furnished very large quantities of lead-covered, steel-armored cable for lighting and power service, we do not happen to remember of having furnished any in single conductor form for use on alternating-current series street lighting system. However, we have made a number of experiments with cable of this sort and are of the opinion that it could be used with entire success under ordinary conditions, since, with the conductor as small as No. 6 B. & S. G. or No. 8 B. & S. G., which is the size ordinarily used for series street lighting systems, and with currents ranging from six amperes to ten amperes, the inductive effect resulting from the steel tape would be relatively unimportant, the magnetic density in the tape being so low that its permeability is of inconsiderable amount.

13—16. What capacity of subway transformers has it been found feasible to install in a single manhole?

(Also answered in April BULLETIN.)

The Philadelphia Electric Company, D. Fred Schick, Philadelphia, Pa.—The largest subway transformer installation on our system consists of two 40-kilowatt and two 20-kilowatt transformers. The average transformer manhole is designed to accommodate two 50-kilowatt transformers.

D. C. Rockwood, Rochester, N. Y.—The feasible limit to capacity of subway transformers in a single manhole depends on:

1. Size of transformer that could be passed through opening into manhole.
2. Size of manhole.
3. Size and number of cables in manhole, that is, on how congested the manhole is. A manhole that would be large for some streets or sections of a city might be wholly inadequate for some other street or section.

This company has a considerable number of 15-kilowatt underground transformers in use, and has more recently added a number of 20 kilowatts. This size is the largest single transformer in our regular subway service. We have, however, cases where several transformers are installed in a single manhole. Thus, in a 5 x8 manhole 6.20 feet deep, near a large public school, we have two 20 kilowatts and one 15 kilowatts; while in another section of the city a 5x5 manhole 5.50 feet deep contains three 5 kilowatts and one 15 kilowatts to supply three-phase power and single-phase lighting to a college laboratory building.

13—17. Has it been found advisable for large subway transformer installations to provide artificial ventilation for the manhole? If so, how has this been accomplished?

(Also answered in April BULLETIN.)

W. L. Sees, General Foreman, Commonwealth Edison Company, Chicago, Ill.—No. City requires ventilation where transformers are placed under sidewalks or in basements. In such cases ventilation has been provided by opening covered with wire netting or by four-inch pipe leading up to the open air.

The Philadelphia Electric Company, D. Fred Schick, Philadelphia, Pa.—We do not ventilate transformer manholes.

13—18. Has it been found advisable to keep transformer vaults separate from the regular manhole?

(Also answered in April BULLETIN.)

The Philadelphia Electric Company, D. Fred Shick, Philadelphia, Pa.—Transformer vaults are not kept separate from the regular manholes on our underground distributing circuits. They are, however, kept separate when the circuit enters conduits carrying our main feeders, when the transformer manholes are so located and constructed that the conduits do not pass through the transformer manholes.

W. L. Sees, General Foreman, Commonwealth Edison Company, Chicago, Ill.—No, but manholes have been made larger where subway transformers were to be installed.

13—20. In operating with reserve 13,000-volt cables, which is the better policy, to keep reserve cables alive on 13,000-volt 'bus (thus subjecting them to possible damage as result of surges on system), or to keep them dead, and take chance on their failing when most needed?

(Other answers in April BULLETIN.)

S. J. Lisberger, Engineer Electrical Distribution, Pacific Gas and Electric Company, San Francisco, Cal.—In the operation of reserve cables on circuits of 11,000 and 13,000 volts, the writer thinks it is better to leave the cables hot or alive at all times. This is the practise of the San Francisco Gas and Electric Company, and we have not lost a cable thus alive from surges.

C. Alcott, Rochester, N. Y.—In Rochester we keep all of our 11,000-volt transmission cables in circuit at all times.

13—23. What would be the best method combining quality and cheapness of connecting temporary street illuminations from an underground system in which no poles at all are used, consumers' taps being taken from service boxes under the sidewalk? Cables, lead-covered, run in tile conduits. There are iron poles for trolley wire construction.

(Also answered in April BULLETIN.)

A. P. Thoms, General Foreman, Underground System, Commonwealth Edison Company, Chicago, Ill.—It is our custom to place cut-out boxes on the outside of buildings and run wires from the customer's service to these boxes, installing one service for each stringer that is to be strung across the street. If lamp posts are to be installed, the best method is to run a piece of iron pipe conduit out from under the sidewalk and up the side of the post at the curb line. This is a cheap method and will look well upon completion.

C. Alcott, Rochester, N. Y.—We find it is cheaper to put street illumination services in permanently, and leave them in for future use. We use lead-covered cables, and bring them out of the top of the trolley poles.

TRANSFORMERS, STORAGE BATTERIES, ETC.

15—55. Has any member company experienced trouble, while operating in parallel banks of three transformers, connected three-phase, by having one bank take more than its correct proportion of load, due to unbalanced voltage? If so, what measures have been taken to overcome the difficulty?

W. M. McConahey, Transformer Engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.—I have never heard of a case of this

kind. If the transformers are all alike and are all connected to similar terminals of the winding, there is no apparent reason for such trouble. If they are of different design, their characteristics may not all be the same, in which case they might not divide the load proportionally, but this would be true with balanced as well as unbalanced voltages.

L. L. Elden, Boston, Mass.—It is believed that this question is not correctly written, as the unbalancing of voltage in a single-phase of a three-phase system to which the transformers in question are connected would simply result in the transformers in that particular phase in each bank taking more or less load than other transformers in the same bank.

The ordinary experience in this matter is that two banks of transformers, connected in multiple on one service, frequently do not take the same load, due to different regulation charactertistics of the transformers themselves. This is ordinarily corrected either by changes in the amount of iron or arrangement of the windings in the transformers, or by the insertion of choke coils in the connections between the transformers.

If this question is incorrectly put, as above suggested, I shall be pleased to supply a definite answer to the question on request.

J. A. Vahey, Boston, Mass.—This trouble is very likely due to the fact that the transformers are not exactly similar with respect to their impedance. When operating in parallel, a slight difference in the value of the impedance of the different transformers will cause an unequal distribution of load and also a flow of cross-current between the banks of transformers.

The following is a simple method of overcoming the difficulty without the use of any special device:

Assuming that the leads between each bank and their common junction are of ample current carrying proportions and, as is usual, of the same size, change those from the bank delivering more than its share of the load to a smaller size and of sufficient length to bring about a balance. A slight difference in the resistance drop between the banks and their common junction will compensate for the difference in the impedance of the transformers.

Obviously, this arrangement should be made under full-load conditions.

Paul F. Williams, Assistant Engineer of Distribution, The Commonwealth Edison Company, Chicago, Ill.—This question is stated in a rather indefinite manner in that banks of transformers connected in parallel divide their load in accordance with the regulation of the transformers making up these banks. If the pressure is unbalanced between the phases, the transformer on the high side of each bank will take more than its proportional amount of current.

In the first instance we have had trouble with banks of three transformers each, being connected in parallel and not dividing their load proportionally between them. As stated above, this is due to the difference of regulation of the transformers, and the only way to remedy the difficulty is to install transformers having the same percentage of regulation.

15—56.—Kindly explain as to the method of checking the ratio of current transformers on high voltage in central stations. Kindly give data, etc.

F. G. Vaughen, Sales Manager Meter Department, General Electric Company, Schenectady, N. Y.—A complete answer to the question, showing the different methods of checking current transformers, would take up considerable space, and as this question is very completely covered by Mr. L. T. Robinson's paper read at the meeting of the American Institute of Electrical Engineers, June 28, 1909, I think that reference should be made to this paper for complete information as to the testing of current transformers.

To test transformers already installed is a difficult proposition and the higher the voltage the more difficult the work. It is necessary to install in series with the transformer under test another transformer which has been standardized and compare the readings. On the ordinary circuit, this does not result in very good readings, as the load is not liable to be steady and the range to be obtained is limited. The method recommended is to remove the transformer and then follow the instructions in Mr. Robinson's paper for making a complete test of the transformer.

R. M. Stevenson, Brooklyn.—A current transformer of known ratio is connected in series with the one to be checked and the two are then compared at various loads.

A. N. Richardson, General Superintendent, Kansas City Electric Light Company, Kansas City, Mo.—If allowable to disconnect the transformer for testing, proceed as minutely explained in the General Electric Review of December, 1910. Otherwise, get a standard current transformer in series with the one to be tested at some convenient point, such as at an air-break switch. Such manipulations can be carried on with the circuit alive.

LAMPS AND ILLUMINATING ENGINEERING

16—41. What experience, if any, have member companies had in the use and installing of the 400 and 500 watt Mazda units, as to life and methods of installing?

(Other answers in April BULLETIN.)

L. W. Layman, Rochester, N. Y.—We have made several installations of 400-watt and 500-watt lamps with very good results, using them in all kinds of conditions. The life has been good with practically no early burn-outs. The effect with the new Holophane reflector seems to be the best for stores, and the "M-M-21" for factory and outside use.

A. H. Sikes, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—We are using 500-watt tungsten lamps to a considerable extent and are having such good results as to life that it is hard for us to state the limit of life. We are selling these lamps made up in a complete unit, consisting of short chain fixture, Holophane shade and lamp complete for $10 each.

17—80. This company has been trying to get a company prominent in the development of lighting fixtures to furnish fixture for inverted lighting with a reflector and outer casing of glass, the outer casing being dense enough and so tinted as to bring the light value to about that of the ceiling above, thereby avoiding the dark underbody of the fixtures now generally used for this work, with the sharp contrasts involved.

A fixture of the above description would be especially suited to rooms where fixture itself is often in the line of vision, such as bed-rooms, hospital wards, etc.

Would there not be a considerable demand for such a fixture?

(Also answered in April BULLETIN.)

H. L. Parker, Illuminating Engineer, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—The writer believes that a demand already exists for a fixture of that type. We have endeavored to interest fixture manufacturers in such a fixture, but so far any experimental work that they might have done has not resulted in a sample fixture or any printed matter describing them.

H. C. Marquardt, Rochester, N. Y.—An inner bowl of prismatic glass with an outer bowl of opal, amber or green glass, would be a great improvement. The demand would depend on the artistic appearance.

17—82. On page 87 of the "Solicitors' Handbook" a table of Reflection Coefficients is given. Where would Holophane reflectors stand on this table, if inserted?

A. G. Rakestraw, Contract Agent, Harrisburg Light, Heat and Power Company, Harrisburg, Pa.—The table referred to was not intended to cover the case of specially designed reflectors such as the Holophane, and it would be difficult to so place them in this table as to give a correct idea of their value as reflectors, since the efficiency of a reflector depends more upon the direction in which the light is reflected than upon the amount. I have no figures upon this matter, but I am sure that the sum of the reflected and transmitted light from a well-designed prismatic reflector should be 95 per cent of the total amount which it receives. This value would place it at the head of the list.

17—33. When member companies replace or have replaced outside Nernst lamps in front of customers' premises with tungsten lamps, what sort of fixture unit is used?

(Other answers in April BULLETIN.)

A. H. Sikes, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—We are using a shade with socket made by the Benjamin Electric Company of Chicago. The shade is made in various shapes and sizes of porcelain enameled steel. We have found it very satisfactory.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—In replacing outside Nernst lamps with tungsten we use a metal reflector supported by an iron pipe which also carries wires to a combination hook and weatherproof cap, the whole in turn being supported by arm previously used for Nernst. We think the metal reflector preferable to glass, as it is difficult to keep glass clean.

Benton Harbor-St. Joe Railway and Light Company, John A. Cavanaugh, Superintendent Lighting Department, Benton Harbor, Michigan.—We have been very successful in installing 400 and 500-watt tungsten lamps to replace gas arcs, a very good form of outdoor illumination, using the Nernst lamp body, simply removing the interior mechanism and installing a G. E. large base receptacle, securing this in place by the same bolts that originally held the Nernst lamp body together. The lower plate of the Nernst lamp body is perforated so as to break very easily at almost the correct size to receive the receptacle. We are using these for sidewalk illumination, show window illumination, also for street lights in a small village.

H. L. Parker, Illuminating Engineer, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—This company uses, as a weatherproof Mazda fixture for installation in the vestibule or on the front of retail stores to replace Nernst lamps and arc lamps, a fixture which is standard with the Benjamin Manufacturing Company, slightly changed to suit specifications established by this company. We use a Benjamin No. T 250 fixture which consists of a weatherproof socket and an 18-inch dished porcelain reflector. The company experienced considerable difficulty in having glass manufacturers furnish a 5 x 10-inch glass ball having the lower half *roughed inside* with a one-inch hole in the bottom. The class of customers desiring a device of this kind usually insists upon using clear lamps. By furnishing the globe the upper half clear, we satisfy their demands, and by frosting the lower half, we reduce the glare considerable when within a short distance from the lamp. The one-inch hole in the bottom is to furnish additional ventilation to the fixture to permit the dust and insects to drop out and not accumulate in the bottom of the ball.

The company supplies this fixture with a stem and canopy or with a goose-neck, and have established prices which include new wiring or attaching the fixture to customer's present wiring. These prices include either a 100-watt, 150-watt or 250-watt clear Mazda lamp—the lamps maintained for one year.

ELECTRIC POWER—MOTORS

19—51. Under what load-factor do the best hydro-electric plants operate?

S. D. Sprong, of J. G. White and Company, New York.—This question can be answered only in the most general way and therefore the value of a reply of this kind is inversely as its generality. Most hydro-electric plants have steam auxiliaries or, what is equivalent, reciprocal contracts with some of their larger customers who have steam plants. However, records of plants that may be considered typical show yearly load-factors of 35 per cent or a little more in systems that are very favorably located as to the type of business handled, but, at the same time, creating no artificial conditions with a special view to raising the load-factor.

On the other hand, taking systems where it becomes profitable to sacrifice the load-factor of the steam auxiliaries to that of the water-power, load-factors of over 50 per cent have been secured. Still further, if their market is subject to control to the extent of modifying the usual working hours in factories and

other industries requiring considerable power, and the selection as customers of factories requiring extra long-hour service, load-factors approaching 80 per cent have been obtained.

H. Hobart Porter, of Sanderson & Porter, New York.—The load-factor under which a hydro-electric plant operates is, as a rule, of the utmost importance financially, for the reason that power is largely sold and paid for on a kilowatt-hour basis and, consequently, the better the load-factor the greater the gross return from a given investment in plant. The operating expenses are usually constant and neither increase nor decrease with changes of load, and consequently the increased gross earnings, due to increased load-factor, appear as additional net income.

The extreme conditions met with in ordinary cases may be illustrated on the one hand by residential lighting in suburban communities, particularly during the spring and summer, which provides a class of business having a very low load-factor, whereas, on the other hand, manufacturing or commercial industries that are carried on continuously day and night throughout the year furnish the best load-factor. The character of a given territory and its industrial possibilities define the ultimate limit to which load-factor may be raised, but a successful management, alert to take advantage of every opportunity, may raise the figure many per cent by combining different kinds of use for energy, as, for instance, by the electrical pumping of water. for irrigation carried in off-peak hours.

In determining the load-factor there is no uniform practise as to the duration of the peak to be used. In a system with which the writer has been familiar for a number of years, where power is sold for incandescent lighting, commercial power purposes and railway power purposes in nearly equal amounts, with a small miscellaneous load from street arc lighting, etc., some careful observations on this subject have been made. It has been found that the maximum indicated kilowatt demand is from 30 to 33 1-3 per cent greater than the maximum hourly demand, as determined by integrating wattmeter. Based upon the latter demand, the load-factor of this system is in the neighborhood of 60 per cent. Based upon the maximum momentary indicated kilowatts, the load-factor is about 45 per cent. The average load-factor of a number of hydro-electric properties with which the writer is more or less familiar varies from 33 to 65 per cent.

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—During the calendar year 1910, our load was gradually being built up and the resultant load-factor for the year was only about 30 per cent. This has improved from month to month and at the present time our average week-day load-factor runs as high as 65 per cent. Our average monthly load-factor will not run high, due to half holidays on Saturdays and due to light loads from midnight to 7 a. m. on Mondays.

We hope still further to improve this by selecting customers with high load-factors requiring long-hour service.

M. R. Bump, General Manager, The Empire District Electric Company, Joplin, Mo.—The daily 24-hour load-factor on our system, which is a combination of steam and water-power plants, varies from 65 per cent to 73 per cent. Our monthly load-factor, based upon maximum demand during any month, in relation to the average continuous load during the month, usually runs between 62 per cent and 65 per cent.

W. N. Ryerson, General Manager, Great Northern Power Company, Duluth, Minn.—The term "load-factor" is a very much abused one, and, in spite of a definition by the American Institute of Electrical Engineers, is still open to considerable misunderstanding unless coupled with the duration of peak, and whether it applies to a day, month or year. Some companies are in the habit of comparing the average output with the installed capacity of generating machines.

The Great Northern Power Company has a daily load-factor of approximately 80 per cent, based on a fifteen-minute peak, and a yearly load-factor of between 50 and 60 per cent.

One other hydro-electric plant with which I am familiar operates under a daily load-factor of slightly more than 80 per cent, also based on a fifteen-minute peak.

In both of these cases the fifteen-minute peak is adopted for the reason that it is possible to obtain this from readings of the integrating wattmeters, thus eliminating the personal equation of the men on the switchboard in taking readings from the indicating instruments.

Both of these hydro-electric plants obtain their high load-factors largely through supplying power to electro-chemical industries having extremely high individual load-factors, and through the diversity of their remaining load. A little study will convince anyone of the wisdom of building up the yearly load-factor of a hydro-electric plant by means of special rates or other inducements in order that the maximum benefit may be obtained from the capital invested.

19—52. What requirements do member companies ask in connection with the installation of elevators, cranes and hoists operated by alternating current motors?

The Philadelphia Electric Company, H. M. Simkins, Philadelphia, Pa.—The following are the Philadelphia Electric Company's requirements:

CLASSES OF MOTORS.

Motors connected to the alternating current, two-phase system are divided into four classes: A, B, C and D.

CLASS A.

Motors of Class A are two-phase of five horse-power and over, used for intermittent service, such as elevators, cranes, certain kinds of pumps, etc. Such motors are frequently started under full load.

CLASS B.

Motors of Class B are two-phase of five horse-power and over, used for continuous service, and are not started frequently, as in case of machine shops, factories, mills, etc.

CLASS C.

Motors of Class C are two-phase under five horse-power.

CLASS D.

Motors of Class D are single-phase of five horse-power and under.

STARTING CURRENT.

CLASS A.

The current required to start motors of Class A shall not at any time exceed double the current required to run such motors continuously at their normal speed while doing the normal work for which the motors are rated.

CLASS B.

The current required to start motors of Class B shall not at any time exceed the current required to run such motors continuously at their normal speed while doing the normal work for which the motors are rated.

CLASS C.

The current required to start motors of Class C shall not at any time exceed three times the current required to run such motors continuously at their normal speed while doing the normal work for which the motors are rated.

CLASS D.

Motors of Class D shall not be used for elevators, cranes, etc., or other intermittent service.

APPROVAL.

Specifications and tests of any new makes of motors must be submitted to and be approved by the company before the motor is connected to its lines. After the motor is connected, it will be subject to a test by the company to determine the starting current required; and if satisfactory, the motor will be finally approved.

ELEVATOR AND CRANE MOTORS, ETC.

REVERSE PHASE RELAYS.

Alternating current motors for passenger and freight elevators and cranes must be equipped with an approved reverse phase relay and circuit breaker which will open the circuit in the event of a reversal of either phase. This apparatus may be purchased from the manufacturers, or will be furnished and installed by the company. Prices of reverse-phase relay equipments for elevator or other motors will be furnished on application.

The circuit breakers furnished with these relays do not take the place of, and are required in addition to, the regular circuit breakers, fuses or other protective devices generally furnished.

Consumers should require that estimates for elevator equipments include this reverse phase relay and circuit breaker.

W. E. McCoy, Electrical Engineer, The United Electric Light and Power Company, New York.—*MOTORS:* All single-phase motors must be self-starting, i. e., they must operate automatically without any control after the switch controlling the motor is once closed, and must release at no voltage.

Motors below one horse-power may be for 110 volts, but when connected to the same installation with larger motors, and when of one horse-power and above, they must be for 220 volts.

For two-phase service, all motors must be suitable for 220 volts and for constant speed work. Those of the squirrel-cage type of five horse-power and above must be equipped with a compensation or starting device which will apply not more than half voltage in starting.

Variable speed motors of the squirrel-cage type below five horse-power may be installed without any starting device other than a switch, but those of 15 horse-power and above must be of the slip ring type.

It is recommended that the company be consulted as to the best type of motor suitable for the particular class of work to be done.

HOISTS: Service for the type of equipment that is usually used in building construction can be supplied where accessible to the mains of the company if operated by a motor of not over 30 horse-power of the slip ring type equipped with the standard type of controller.

It is recommended that the question of service for this work be taken up with the sales department as far in advance of requirements as possible.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Company, Denver, Colo.—The regular power rates apply upon all polyphase motor installations.

Contractors' hoists are operated upon single-phase, 220-volt circuits, which are the outside wires of the secondary lighting systems, but must observe the "off-peak" schedule.

H. B. Gear, General Inspector, The Commonwealth Edison Company, Chicago, Ill.—The starting current must not exceed three times normal full load current of the motor. Motors of 50 horse-power or larger must be of wound rotor type.

METERS

20—75. What experience have member companies had with Wright maximum demand meters on three-phase motor installations?

(Other answers in April BULLETIN.)

H. T. Sands, Boston, Mass.—We have used the Wright Demand Indicator on three-phase motor installations for some time, but are now using the Watt Demand Indicator in its place.

If the power rate is based upon the KVA of demand, the Wright Demand Indicator is a satisfactory device; but if it is desired to obtain the true kilowatts of demand, the variation in power-factor correction makes it an undesirable instrument to use.

20—76. Will some member company give information in regard to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

C. A. Dean, Head Installation Department, Cambridge Electric Light Company, Cambridge, Mass.—Unless member company making inquiry is very well equipped for this work, we do not believe it would pay to rewind armatures, as same can be bought of the manufacturer at a reasonable price.

Allegheny County Light Company Section, Pittsburgh, Pa.—The old wire is removed from the cores, which are then soaked in alcohol for about a half hour in order to remove the old shellac and dirt. The core is then placed in a "U" shaped holder on a horizontal winding machine which is equipped with a counter. One thousand turns of No. 40 S.S.C. copper magnet wire are then wound on, a loop thrown out, the core revolved one slot, and one thousand more turns wound on and a loop thrown out. This is continued until the eight coils are wound. A piece of No. 32 S.S.C. copper magnet wire is twisted around the loops to form the leads to the commutator. For sixteen segment commutators a loop is taken off at the 500th turn of each coil and connected to the commutator. One piece of .001 white tissue paper is used between coils. The finished armature is then immersed in shellac for a few minutes, then baked for twelve hours. It is considered good practise to set the armatures away for about three months or more to age, but this rule is not always adhered to.

20—76a. What has been the experience of member companies with the new 25 cent prepayment meter? What is the average monthly revenue per meter? What do you figure must be secured as the minimum revenue per meter before the installation of this meter pays?

(Also answered in April BULLETIN.)

J. T. Day, Superintendent, Malden Electric Company, Malden, Mass.—Our experience with the new 25-cent prepayment meter has not been very satisfactory, having had considerable trouble with the prepay mechanism failing to cut off, thereby causing us a great deal of difficulty in collecting the shortages. In fact, we have stopped the use of this style of meter almost entirely, and what few meters we have installed, are mostly for delinquent customers, where collection has been a source of considerable expense.

20—77. Have any member companies made any tests with oil for use with meter jewels?

William Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—We have made it a practise not to use oil on meter jewels, the reason being that dust will not grind a stone without the presence of a binding material such as oil.

G. A. Sawin, Chairman Meter Committee, National Electric Light Association, Newark, N. J.—We have made various tests on oil in jewel bearings and it is our opinion that all jewels should be oiled. The amount of oil, however, is still an open question, whether to use a trace or flood the bearing. I am inclined to believe that flooding is correct, but the data to date is not sufficient to definitely say that this practise is correct.

W. E. McCoy, Electrical Engineer, The United Electric Light and Power Company, New York.—This company has been conducting tests for eleven months, but no conclusions can be drawn from the results of tests up to this time.

F. P. Cox, General Electric Company, West Lynn, Mass.—We have made very extended investigation as to the use of oil in the meter jewels, and very strongly recommend the use of oil.

20—78. What companies have had trouble with rust on the iron clock plate on the Westinghouse induction meters? What has been done to eliminate this trouble?

William Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—The type C-f meter has been equipped by the manufacturers with an oil reservoir, consisting of a felt pad saturated with oil.

The pad is placed on the clock plate and always keeps the plate, bearings and pinions well oiled. No doubt the manufacturers could supply these for use on the older types of meters.

G. A. Sawin, Chairman Meter Committee National Electric Light Association, Newark, N. J.—We have had a little trouble with rust, but not enough to be serious. We understand that the construction of the meter has been changed so that this plate will be permanently oiled. It is claimed that this will eliminate entirely the trouble of rust upon the clock plate.

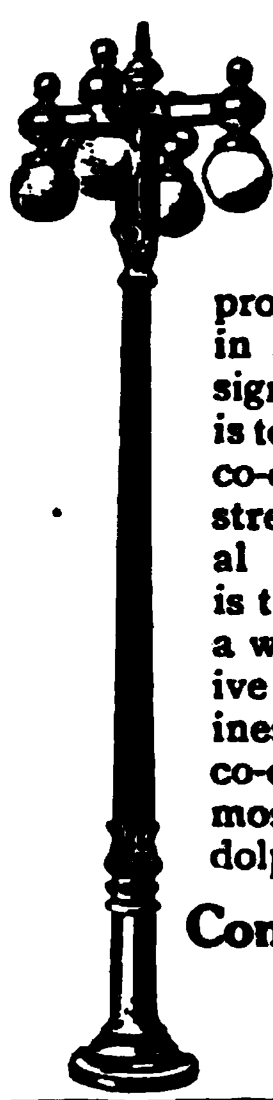
W. E. McCoy, Electrical Engineer, The United Electric Light and Power Company, New York.—This company has had some trouble with rust on bearing plate referred to. Trouble eliminated by renewal of plate—this costs only a few cents.

COMMERCIAL

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

An excellent advertisement used by the Commonwealth Edison Company, Chicago:

Attracting Trade



For attracting the transient public to a store after dark no method has proven so economical, year in and out, as the electric sign. What an electric sign is to the individual merchant, co-operative and uniform streetlighting with ornamental Tungsten Street Posts, is to the business section as a whole. It is the most effective way to popularize a business center and, under our co-operative plan, it is also the most economical. Call Randolph 1280 for particulars.

Commonwealth Edison Company
139 Adams Street

D. McJunkin Advertising Agency, Chicago. 952U

21—27. What member companies have solicitors working exclusively on electric sign business?

In answer mention population, also if the results have been satisfactory, the cost and yearly income per 50-watt equivalent.

Joseph F. Becker, Sales Manager, The United Electric Light and Power Company, New York.—We have no solicitors working exclusively on electric sign business, as our sign work is done in connection with our general district work. We are meeting with considerable success in connection with the

low-voltage, 5-watt tungsten lamps. A number of our customers have lately appreciated the economy derived from this type of lamp and are taking advantage of this feature.

J. L. Wiltse, Chief Clerk, Edison Electric Illuminating Company of Brooklyn.—The Brooklyn Edison Company has, in addition to its regular salesmen, two special solicitors for securing sign business. In addition to this, their work covers the installation of any advertising lighting such as decorative street posts or the outlining of buildings.

We have been very successful in obtaining considerable business in each of the above classes.

We have a special advertising flat rate which amounts to $13.75 per year per 100 watts connected. This flat rate is based on an average use of five hours per night for every night in the year. The installation is turned on and off by the company's patrolmen.

E. A. Mills, New York Edison Company.—This company has had solicitors working on electric sign business exclusively for a number of years and the results obtained have been highly gratifying. At the present time the company furnishes to customer a panel type of sign which is lettered in accordance with the customer's idea and hung by the company. The wiring is installed by a wiring contractor, the company defraying the entire cost and the customer repaying in monthly installments due in one year. Where a larger or more spectacular sign is desired the company furnishes to the customer designs and sketches, as desired, for the customer's approval. Upon his approval these designs are forwarded to the various sign manufacturers for competitive bids, the customer making his own selection. This plan has worked out very nicely to the advantage of all concerned. As separate meters are not set for sign installations it is impossible to determine the yearly income.

E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company have had separate men working exclusively on the electric sign business for about eight years. The results have been very satisfactory indeed, as we have on our system to-day about 4000 rented signs in addition to the signs owned by customers, which approximate 5750. We estimate our average yearly income from signs to be one hundred dollars per sign. It is difficult to give the income per 50-watt equivalent, as the number of lamps varies a great deal. The population of Chicago, as determined by the last census, is 2,185,283.

E. L. Callahan, Chairman Sign Committee, National Electric Light Association, Chicago, Ill.—We have several solicitors in the employ of our New Business Department, who are sent around from city to city, devoting the majority of their time and attention to the securing of electric sign business. We feel that this is profitable, excepting where the local solicitor or solicitors are exceptionally good sign salesmen, in which latter case they are able to take care of the sign business without assistance.

At one property, population 50,000, we have a sign solicitor devoting his entire attention to the securing of sign business and find it very profitable. In larger cities, I believe the best plan is to have special men employed, for I believe thoroughly in specializing where local conditions permit. The cost for a sign expert in a city of 50,000 inhabitants, is about $1,800 a year, and it is reasonable to expect, with low-voltage, 5-watt lamps, yearly income of about $2,000, from current alone, or $4 per year per 50-watt equivalent.

A. K. Young, Commercial Manager, Bristol Gas and Electric Company, Bristol, Tenn.—To the best of my knowledge, the following companies have exclusive sign solicitors:

Denver Gas and Electric Company, Denver, Colo.
Empire District Electric Company, Joplin, Mo.
Montgomery Light and Water Power Company, Montgomery, Ala.
Meridian Light and Railway Company, Meridian, Miss.
Lincoln Gas and Electric Company, Lincoln, Nebraska.

I understand that the results have been very satisfactory in each instance.

L. R. Wallis, Superintendent Sales Department, The Edison Electric Illuminating Company of Boston.—At the present time and for some years, we have not had special solicitors for electric sign business. When special solicitors

on this class of business were tried out, it did not prove to be a very satisfactory experience, and they were withdrawn from such specialization.

James T. Maxwell, General Agent, Philadelphia Electric Company.—This company has solicitors working exclusively on sign business. The soliciting cost per 50-watt equivalent for year ending

March 31, 1910	$0.37¼
Number of signs—12 months	672
Number of lamps in same	31,105
Number of 50-watt equivalents	7,223
Average revenue per 50-watt equivalent	$5.00

The results have been satisfactory.

Population of city last census 1,549,000

Ross B. Mateer, Power Expert, The Denver Gas and Electric Company, Denver, Col.—All electric sign solicitation is under the supervision of the sign engineer, who is a specialist on the work. The territory representatives refer all questions to the sign engineer and request his co-operation in all large or special installations. Results are very satisfactory.

Edward Curry, General Contract Agent, Economy Light and Power Company, Joliet, Ill.—Joliet is a city of 34,000 population, and while we have no solicitor for sign work exclusively, we have a sign load as follows:

FLAT-RATE ON PATROL.

Number of Signs	Kind of Sign	Number of Lamps	50-Watt Equivalents	Income per Month	Income per 50 Watt per Month
30	Federal Lamp letter	3,320—2 C. P.	664	$458.50	.69
19	Federal Panel	680—2 "	112	113.53	1.01
5	" "	128—4 "	51	45.77	.90
7	Various Makes	21—60 Watt	25	20.45	.82
3	" "	19—40 "	15	11.57	.77
7	" "	49—25 "	24	14.95	.62
4	" "	20—16 C. P.	20	9.58	.48
2	" "	21— 8 "	13	7.82	.60
77		4,258	924	$682.17	.738

Yearly income for the above signs $8,186.04.

Yearly income per 50-watt lamp $8.859.

Besides the above we have about fifty signs of various makes, ranging from four lamps to two hundred and fifty lamps per sign that are owned by and turned on and off by the customer.

We consider the results have been most satisfactory as our window lighting income has increased due to the brighter appearance of the street.

L. W. Layman, Rochester, N. Y.—We have a salesman who devotes all his time to sign and exterior display, furnishing designs, etc., quoting prices on complete installation, figuring a small profit to cover cost of selling, acounting, collecting, etc. The wiring and erecting is sub-let to the contractors.

The population of Rochester is about 225,000.

We are getting good results. The small profit added to the sale price covers the salesman's salary. We have something over 600 kilowatts connected load in signs and it is rapidly on the increase.

Allegheny County Light Company Section, Pittsburgh, Pa.—We have two solicitors whose time is devoted exclusively to securing electric sign business. The population of Pittsburgh, Pa., is approximately 600,000. This service is principally supplied with five-watt tungsten sign lamps, which operate on a flate rate of 12 cents per lamp for installations of less than one hundred lamps, and 11 cents per month for installations of one hundred lamps and over. This rate includes burning the lamps from dusk until 12 o'clock midnight, the first installation and subsequent renewals of lamps and loaning the customer the necessary sign transformer. We also have signs installed which register on the customer's regular service meter.

21—28. Would like to get from members data on heating different kinds of buildings, as we find this important in trying to shut down isolated plants. Please give length of heating season, kind of building, pounds of fuel per cubic foot of building for heating season, price of fuel per ton of 2240 pounds, kind of heating system used and pressure required.

E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—It would be impossible to answer this question correctly without knowing at great length all the conditions surrounding the building, in the way of glass space, wall space, city where building is located and such other information as is necessary in estimating on this kind of service. I believe the person asking the question can secure all the information necessary from a paper presented by Mr. S. M. Bushnell, entitled, "Central Station Operation of Steam Plants in Connection With Lighting Service," before the 1909 convention of the National Electric Light Association at Atlantic City.

E. R. Davenport, Sales Manager, Narragansett Electric Lighting Company, Providence, R. I.—The following data has been obtained on several buildings in Providence:

The buildings tabulated are all office and bank buildings with the exception of the Hotel Newman. We also obtained data on various jewelry factories in Providence where coal consumption per year of twelve months varies from one-half to one pound per cubic foot of contents. In some cases, we have found that the coal consumption would even exceed one pound per cubic foot. There is so much variation in the results obtained from buildings of this description that it seems to be practically useless to quote any definite figures. With propositions of this description, where considerable live steam is used throughout the year, we believe that each case must be considered separately.

Name of Building	Cubic Contents Feet	Direct Radiation in Sq Ft.	Coal per Cubic Ft. of Contents Lbs.	Coal per Sq Ft. of Radiation Lbs.	Number of Cubic Ft. of Space Sq. Ft. of Radiation
Providence-Washington	351,000	4,500	0.6836	53,333	78.00
R. I. Hospital Trust.........	227,205	3,000	0.6162	46,667	75.73
Merchants' Bank Building....	160,974	2,025	0.7952	63,210	79.49
Old National Bank...........	125,550	1,300	0.6372	61,538	96.58
Conrad Building	421,848	5,000	0.8723	58,462	84.37
Barnaby Building	139,293	2,680	1.1199	58,209	51.97
Hoppin Homestead	629,856	6,000	0.5954	62,500	104.97
Lyman Building	132,940	1,620	0.8274	67,901	82.06
Davis Building	128,800	2,100	1.1646	71,429	61.33
Chapin and Fearing Buildings.	185,097	2,045	0.8644	72,239	90.51
Francis Building	238,972	3,761	0.8369	53,177	63.54
Plymouth Building	83,309	1,175	1.0087	71,489	70.90
Savoy Building	165,000	2,060	0.6160	——	——
Brech Building	129,870	——	0.7273	58,252	80.10
Lederer Building	221,760	3,400	1.0159	66,262	65.22
Hotel Newman	462,315	4,935	1.0382	97,264	93.68
Blanding & Blanding.........	102,000	700	0.4117	60,000	145.72
A. O. Miles & Company.......	31,700	338	0.7571	71,006	93.79
Lyceum Building	147,600	1,500	0.5285	52,000	98.40
Blank No. 1.................	600,000	6,006	0.5767	57,609	99.90
Blank No. 2.................	135,000	1,700	0.7111	56,471	79.41
Blank No. 3.................	126,684	1,550	0.5368	43,872	81.73
Wilcox Building	315,900	——	0.5698	——	——
Burrill & Trocedero..........	916,490	——	0.7638	——	——
Hodges Building	585,000	——	0.9406	——	——
Vaughn Building	306,280	4,000	0.8815	67,500	76.57
Average	271,940	2,790	0.7729	62.29	84.27

E. F. Tweedy, New York Edison Co., N. Y.—In order to obtain a basis for estimating approximately the amount of coal required to heat a given building in New York City when its glass and wall exposures are known, actual coal

consumption figures were obtained for a large number of different kinds of buildings using central-station service for light and power, and the wall and glass exposures of these buildings were carefully determined.

To avoid the uncertainty which arises in providing for the leakage loss on the basis of assuming an arbitrary number of air changes per hour, it was decided to combine this loss with the radiation loss. Such a combination was

deemed possible by the following line of reasoning: The leakage loss being proportional to the summation of the window perimeters (assuming the leakage space to be approximately constant in width), and the size of windows in similar types of buildings being fairly uniform, it becomes possible to consider the leakage loss as a function of the total glass surface without very appreciable error.

In reducing wall exposures to equivalent glass, a figure of 4.5 was assumed as an average figure for the types of building construction found in New York City. Having made the foregoing assumptions, the following equation results:

$$T = \frac{1}{K}\left(\frac{W}{4.5} + G\right) + \frac{1}{K^1}G$$

T = Tons of coal consumed per year for heating.
W = Total exposed wall surface in square feet.
G = Total glass surface in square feet.
K & K^1 = Constants.

As it is not necessary to solve the above equation, K and K^1 need not be actually determined; for purposes of plotting, however, a relation between K and K^1 must be obtained. For $K = K^1$ the equation evidently becomes

$$T = \frac{1}{K}\left(\frac{W}{4.5} + 2G\right)$$

The relation between K and K^1 can be varied considerably without affecting the results to any appreciable extent other than to alter the value of K. For $K = K^1$, $K = 100$, which is a very convenient quantity for practical use.

Figure I shows twenty office and loft buildings plotted from the equation in the above form, and it will be seen that the values conform very closely to the equation as given. The loft buildings shown on this chart are not what are known as manufacturing lofts, but are devoted mostly to sales purposes, although in some instances a certain amount of light manufacturing is done.

It will be observed that pea coal was burned in all of the buildings cited. Data was secured, however, on a number of buildings where the buckwheat coals or various mixtures were being used. All such cases—as would naturally be expected, due to the lower calorific value of such fuels—fall above the pea coal line, but in most cases to a considerably greater extent than is to be explained by the difference in the thermal value of the fuels. This can undoubtedly be accounted for by the fact that these poorer grades of coal are rarely burned, in the ordinary heating plant, under proper conditions as regards type of grate and draft, thereby nullifying the saving which might otherwise result from their use.

For apartment house buildings the same general relation has been found to hold good, the only difference being that the value of the constant K is less, being about 60 instead of 100. This is, without doubt, due to the generally poorer construction of such buildings and to the fact that heat is required for more hours during the day and that the windows are opened more frequently.

Figure 2 shows the coal consumption for the same office and loft buildings as shown in figure 1 plotted against the gross volumes of the buildings above ground. It will be observed that there is no close relation between the coal consumptions in these buildings when compared upon a volumetric basis, and such a method of estimating the heating requirements of a building is therefore open to considerable error.

The length of the heating season in New York City is approximately 200 days. The following table shows the average monthly temperature, for the past forty years, for the months October to May inclusive.

October	55.6
November	43.9
December	36.0
January	30.6
February	30.7
March	37.8
April	48.7
May	59.8

The cost of pea coal, which is the grade of fuel used in the buildings cited above, is approximately $4 per ton of 2000 pounds. No. 1 buckwheat coal costs from $3.25 to $3.50 per net ton.

The heating systems in the buildings given above are mostly single pipe, although certain of the buildings have the two-pipe system. The steam pressures average about five pounds.

21—29. What central stations rent vacuum cleaners to their customers? What rental is charged?

H. L. Parker, Illuminating Engineer, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—This company rents Magic vacuum cleaners, with or without attachments, for $1 a week or $3 per month. This cleaner is sold without attachments for $36 cash, or $38 time payments. This price includes establishing service in a residence not wired by the following method of wiring: Conduit on the outside of the residence starting at a point on the level with the top of the first floor windows, where the service loop is attached, conduit extending down through the wall into the basement where the meter is set. From a knife switch at that point No. 10 wire is run in wood molding on the ceiling of the basement to a point directly underneath the wall between the dining-room and the front hall, where a plug type fuse cut-out is placed on the ceiling of the basement and No. 12 wire run to a 20-ampere baseboard receptacle placed in the dining-room baseboard. This provides an outlet suitable for a portable reading lamp or any of the heating appliances ordinarily used in the dining-room.

The vacuum cleaner is supplied with 50 feet of cord with an attachment plug. An extra length of 8 feet of cord is given with each wiring installation, on one end of which is a 600-watt socket, and on the other end a cap to fit the receptacle installed. This reduces the 20-ampere receptacle to a standard basis so that any of the smaller appliances can be used and also provides the extra length of cord necessary should the customer desire to use an iron connected to that outlet.

Additional baseboard outlet with a 20-ampere receptacle is placed at any point in the house at $4.80 each. For each of these baseboard outlets a pair of No. 12 wires is connected to the main in the basement and a plug-type fuse installed where it is connected to the so-called main in the basement.

Geo. H. Sander, Commercial Superintendent, Manchester Traction, Light and Power Company, Manchester, N. H.—We rent vacuum cleaners of the vertical diaphragm type, with complete set of tools, to our customers, for $2.50 per day. This price covers the cleaner rental and cartage both ways, but not the services of an operator.

Aside from the profit derived from rentals we have always considered this good business on account of the vacuum cleaner sales and permanent installations which frequently result therefrom.

R. E. Brown, Vacuna Sales Co., New York.— The Allegheny County Light Company rents vacuum cleaners at $2 per day. They have sent out notices to their customers, reading:

"Don't make your Spring housecleaning an annual hardship to be regarded with dread. An electric vacuum cleaner attached to an ordinary electric light socket draws every particle of dirt from carpets, furniture, pictures, wallpaper and from every corner and crevice usually overlooked, and deposits it in an air-tight receptacle from which it can be quickly emptied on the yard fire. It takes germs and all, leaving the room sweet and clean. It is play for a woman to operate it.

"We rent the best vacuum cleaners at $2 per day. Call 3200 Grant and arrange for one before the Spring rush begins.

"THE ALLEGHENY COUNTY LIGHT CO.

"435 Sixth Avenue,
"6012 Penn Avenue, East End."

A. G. Rakestraw, Contract Agent, Harrisburg Light, Heat and Power Company, Harrisburg, Pa.—We rent vacuum cleaners to our customers at $2 per day, including delivery and collection. We deliver by our electric truck and the driver instructs the customer how to operate the machine, but we furnish no

other service for this price. We do not bill customers for this rental, but collect the money when we get the machine. We also have one or two large machines which we rent out for $7 per day, including the services of two men.

C. R. Hayes, Manager, Fitchburg Gas and Electric Light Company, Fitchburg, Mass.—This company makes a practise of renting vacuum cleaners to its customers, there being a considerable demand for this service. The price charged is $3 per day and the machine is delivered to the customer, instructions given as to its use, and later removed from the customer's premises.

William A. Donkin, General Contracting Agent, The Allegheny County Light Company, Pittsburgh, Pa.—We rent vacuum cleaners to our regular customers at a rental of $2 per day. Where they require an extension cord we charge 25 cents per day extra. We have ninety-five machines in operation, which we deliver in the morning and collect in the evening. Our receipts from the rental of machines for the past year amounted to approximately $6,900.

Alan Leslie Cary, Wilmington and Philadelphia Traction Co., Wilmington, Del.—This company has not any rental proposition for vacuum cleaners, but a department store in this city rents electric vacuum cleaners at $1.25 per day.

21—31. Have any member companies given complete lists of their customers to appliance manufacturers for them to circularise their advertising matter? What have been the results?

H. K. Mohr, Advertising Manager, The Philadelphia Electric Company, Philadelphia, Pa.—The Philadelphia Electric Company, as a matter of policy, has never given complete lists of its customers to appliance manufacturers. Upon several occasions, however, a selected list of our residence customers has been furnished, that is, a list of about 1500 or 2000 of our residence customers has been compiled, which list contains the names of those people who would be most apt to purchase and make use of the various electrical household appliances which are put on the market from time to time.

Results, judged by the number of new appliances placed by circularizing this list, have never been very great, which may or may not be the fault of the marketing methods of the manufacturer.

This matter can be handled by having the appliance manufacturer furnish the central station with its printed matter—circular letters, booklets, etc., properly enveloped and stamped—the central station could then have these envelopes addressed from its list of customers, either charging the manufacturers for this work or assuming that expense themselves. Also, the advertising of the manufacturer could be sent to the customer with monthly bills and statements, which method would obviate the necessity of furnishing the list of customers.

There are several reasons why it is not considered good policy to give our lists of customers to outside parties: Improper uses might be made of such lists; excessive circularizing might become a distinct annoyance to the customers.

C. Nast, Manager Advertising Bureau, The New York Edison Company.—This company never gives out its list of customers to any manufacturers for circularizing purposes. This has been its policy for years, and there has never been any change.

F. H. Gale, General Electric Company, Schenectady, N. Y.—I do not recall that any central stations have furnished lists even approximately complete, of their customers, to appliance manufacturers. There is a movement on foot, however, which is of interest in connection with this inquiry, and the idea originated with the sales superintendent of a large central-station company. The plan is as follows:

The central station furnishes regularly to the appliance manufacturer the names and addresses of the persons who are putting up new buildings in the central station's territory. The manufacturer then mails to these addresses advertising matter and literature intended to promote interest in the use of electricity in the home, including preferably, suggestions regarding illumination, electric cooking, the use of various motor-driven appliances, and the proper arrangement of outlets throughout the building.

Obviously if this plan were adopted by all central stations and all appliance manufacturers, the interest in the uses of electricity in new buildings would be very materially increased throughout the country. The central station, of course, follows up such prospects by means of personal work on the part of their solicitors, regardless of their own advertising, and obviously it will be of great advantage to have this work supplemented by the direct distribution of advertising matter on electrical subjects from the manufacturers.

The General Electric Company would be very glad to hear from central stations who are interested in co-operating in this manner.

L. D. Gibbs, Superintendent of Advertising, Edison Electric Illuminating Company of Boston.—The Edison Electric Illuminating Company of Boston has never allowed lists of its customers to go out of its direct control. The company has maintained that a list of the users of electric service comprises one of the most valuable mailing lists that anyone could secure, and if it was once out of the company's control might be used for all sorts of campaigns, to the discredit of the Boston Edison Company and the discomfort of its customers.

The company has, however, co-operated with appliance manufacturers in this way: The manufacturer has prepared the material to be mailed—either form letters, catalogues, cards or other advertising matter—and delivered this matter with the postage affixed to the superintendent of advertising. The latter has then assumed the responsibility of getting the material into the mails properly addressed. Sometimes this has been accomplished by running the matter through the addressograph in the company's billing department, and sometimes the addresses have been taken off on rolls from the addressograph and turned over as confidential matter to a local mailing company with the advertising material, and the mailing has been done in that way. After the mailing has been completed, the rolls of names have been returned to the company and destroyed.

Two years ago the Boston Edison Company did this sort of co-operative advertising with several electric appliance manufacturers, especially several making a feature of electric fans. The company was informed that the results were highly gratifying.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—Not complete lists, but have given several hundred names to appliance manufacturers that they might circularize them. In general, do not think the results obtained were worth while, unless the manufacturer established a local agency.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

(Other replies in December, January, February, March and April BULLETINS.)

George H. Jones, Power Engineer, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company is just putting into effect an "off-peak" power schedule for alternating current installations where the maximum load is 200 kilowatts or over. The "peak" periods are from 4 to 8 P. M., during the months of November, December, January and February. If power is not used during these hours, a substantial reduction from regular wholesale rates is made. In these cases a stamping watt-meter is installed so that it can be readily determined as to whether or not power has been used during the "peak" periods.

S. J. Lisberger, Engineer Electrical Distribution, Pacific Gas and Electric Company, San Francisco, Cal.—The San Francisco Gas and Electric Company and the Pacific Gas and Electric Company both give off-peak rates. An off-peak rate is given in the case of manufacturing industries, refrigerating plants, etc., which have a high load-factor. Time switches are used in connection with the integrating watt-meters for proper control.

Geo. W. Teffeau, Jr., Engineer, Willimantic Gas and Electric Light Company, Willimantic, Conn.—We give 12½ per cent off all gross power bills to the customer who does not operate motors on his circuit between the hours of 4.30 P. M. and 9.30 P. M., between the dates of September 15th and the following March 15th. Copy of our power schedule herewith enclosed, which can be sent to the party making inquiry. All our restricted-hour customers are under

contract which binds them to refund to the company all discounts allowed for a year previous to the violation of their contract. At present we find it only necessary to depend on our inspectors.

L. F. Philo, Sales Manager, Union Electric Light and Power Company, St. Louis, Mo.—Off-peak rates of 25 per cent discount from our regular schedule are allowed by this company on power connections of 20 horse-power and over for exclusive use of the hours of 4 to 8 P. M. from November 15th to February 15th. Installations of 50 kilowatts and under are controlled by time switches; larger ones supervised by graphic recording ammeters. Use of this class of service on the peak forfeits the discount. We have a special cooking and heating rate for residence customers who provide separate circuits for this purpose.

A. G. Rakestraw, Contract Agent, Harrisburg Light, Heat and Power Company, Harrisburg, Pa.—We give special five cents per kilowatt rate for heating and cooking service. We assume that this demand will be off the peak, though we have no system of regulating it. We have no standard system of off-peak rates. Strictly off-peak service should be furnished at the base rate, neglecting fixed charges. Very likely the most satisfactory way of regulating this service would be to have a written contract covering the matter and inspect at intervals to make sure that the contract was being observed. Where the size of the installation justifies the expense a curve drawing meter will serve as a positive check.

22—47. Wanted: Information from member companies, regarding the amount spent by the cities in which they are located per square mile for street lighting service. In other words, I wish the result obtained by dividing the number of square miles in the city by the yearly appropriation for street lights.

(Other replies in March and April BULLETINS.)

M. T. Flynn, Local Manager, The Standard Electric Light Company, Kansas City, Kansas.—In Kansas City, Kansas, the appropriation for 1910 for street lighting was $42,500 or a levy of 5 mills on the assessed valuation, which is approximately $85,000,000. This appropriation amounts to $2,615 per square mile.

Memphis Consolidated Gas and Electric Company, C. K. Chapin, Engineer, Memphis, Tenn.—The City of Memphis covers 19.5 square miles and the yearly appropriation for lighting is approximately $100,000, making an expenditure of $5,128 per square mile.

22—51. Do member companies consider it absolutely necessary to have a regularly executed contract with all customers before service is connected? The idea is this: grocers, butchers, icemen, milkmen and other tradesmen regularly supply a service to householders, often amounting to several times the cost of the service we render each month, and this is done without a contract, application, or other written memoranda. Is the central station's business so different that it cannot be conducted on the same basis?

F. D. Adams, Treasurer, New Haven Electric Company, New Haven, Conn.—We do not install a meter without a contract.

L. A. Coleman, Assistant Secretary, The United Electric Light and Power Company, New York.—This company does not always wait to have the contract executed before connecting the service. The service is connected up first and the contract follows. We are of the opinion that an application is essential, being the equivalent of the written order used in all business. We cannot sustain an action for money owing for service supplied without producing this written application.

John Meyer, The Philadelphia Electric Company, Philadelphia, Pa.—It is not absolutely necessary to have a regularly executed contract with all customers before service is connected. It is desirable, however, for the reason that there are usually specific conditions regarding service cost, and how it shall be assumed, the capacity for which the company contracts, and the minimums and rates under which this service shall be supplied, which are not found in the business of the grocer, butcher and other tradesmen.

Where goods are sold by tradesmen on a credit basis, a bill is rendered with the goods delivered, followed by a statement at the end of the month. The

goods are definitely named and the price per unit specified, at the time of purchase, or in the bill as rendered. This credit is extended by large business houses only after an investigation of the financial standing of the purchaser, or by the small tradesmen who may be willing to take a chance, being acquainted with the purchaser.

With a central station, where the business is considerably greater than that of the average tradesmen, and where a number of representatives are required to transact its business, it is essential that the conditions under which any sale is made should be defined in a regularly executed contract, and not left to the veracity of the parties to such a transaction.

There are cases, however, where the integrity and financial standing of the individual or concern is such as to justify the company making the connection to be followed by a regularly executed contract. These cases, however, should be the exception and not the rule.

The individual or firm who is unwilling to sign a contract containing the conditions upon which he or they are willing to purchase current does not deserve your confidence.

Thos. W. Peters, Commercial Agent, Columbus Railroad Company, Columbus, Ga.—If central stations could sell electric current by pint, quart, or pound, and could deliver it in packages the same as butchers, icemen, milkmen or grocers, then there would be no need for contracts, but so long as they are unable to have any control over the use of current on the customers' premises, it is advisable to have some form of contract or agreement.

Mike S. Hart, General Manager, Consumers' Electric Light and Power Company, New Oleans, La.—The comparison between the service rendered by a grocer, butcher, iceman, milkman or other tradesmen, and that of an electric light corporation is, to my mind, entirely erroneous and not at all similar, for the reason that the business of a tradesman is carried on by an individual or a private or small corporation which requires no public permission for its existence other than the payment of its taxes, license, etc.

The business of furnishing electricity to a community is usually done by virtue of a franchise or grant given a corporation through the regularly constituted authorities representing the municipality as a whole.

The commodity that is being sold by the ordinary tradesman is regulated in price only according to the conditions of the market, in so far as supply and demand is concerned, and the tradesman is not compelled by law to supply any person or persons, and is at liberty to choose his customers. The service that is rendered by a lighting company comes under the head of service that is rendered by a public utility company, and as such is regulated in so far as capitalization and rates are concerned either by local or state regulation, and the public utility company has to supply all those who make application to it upon the same terms and conditions.

The use of a lighting company's product is regulated and prescribed by certain laws and regulations that are enforced by municipal and insurance authorities, and in cases where these conditions exist it becomes part of the contract, and the applicant for service agrees to perform certain duties in regard to his wiring and agrees to use the electrical service in the form and manner prescribed by the contract.

The tradesman has no public supervision of his business, and can deal with his customers in any way that he may see fit, while the electric light company, being a public service corporation, has to deal with and treat all alike.

This company has always entered into written contracts with its customers, and we cannot see how a more satisfactory arrangement, to all concerned, could be made.

H. T. Sands, President, Malden Electric Company, Mass.—The crux of this question is contained in the last sentence, and the answer is that the central station's business *is* different from that of the ordinary merchant, and from its very nature, requires different practises along certain lines.

In the case of the grocer, he has no permanent fixed investment on the customer's premises; whereas, in order to serve a customer, we must have a

fixed investment in transformer, service wire and meter. Furthermore, we have different classes of service—namely, lighting, power, long and short hour users —and to my mind it is not only necessary, but also good business, to have something that will show that the customer understands the conditions under which he is purchasing our service and agrees to these conditions.

A long and complicated contract is decidedly undesirable, but a simple form of application card, on which the customer states that he applies for service and agrees to abide by the company's rules and regulations as applied to that service, is to my mind a necessary procedure.

W. T. Nolan, Rochester, N. Y.—It is our practise to obtain signed contracts for our services, but if an emergency case arises, we install the service, and have the contract signed afterwards, providing that we know the standing of our customer.

I do not think that the service rendered by lighting companies should be classified with that of grocers, butchers and other merchants. A public service corporation is obliged to treat all customers alike under the law, and in cases where a dispute arises over an account, it is much easier to collect it if a signed contract is on record.

O. R. Hogue, Special Agent, The Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company has an application or contract signed in all cases where they furnish service. Lighting service is furnished under our standard scale. The contract is not drawn for any definite period, nor does it provide for a minimum monthly bill. Where we furnish service for power, we ask a minimum monthly bill of fifty cents per connected horse-power. The contract is drawn for a period of one year. Wholesale contracts are drawn for a period of five years. Tradesmen can sell their goods without a contract and as a rule their obligation ceases immediately upon delivery of goods. An electric lighting company's obligation never ceases, and if they do not have an application or contract which stipulates that the company does not guarantee that the supply of electricity will at all times be constant and further agrees that temporary cessation of the company's service occasioned by fires, strikes, casualties, accidents, break-downs of or injuries to machinery or distributing lines, shall not be considered a breach on the part of the company and the company shall not be liable to the consumer for any damages resulting from such temporary cessation of service, the company would have a legal proposition on its hands resulting from inferior wiring installed by incompetent men.

MANAGEMENT

23—31. Do our large central-station companies in working out the B. T. U. per pound of coal make use of the actual calorimeter measurements or calculate the heat units by means of formula from the analysis? If the latter case, give formula which you have found particularly applicable to semi-bituminous coals of the eastern district.

(Other replies in April BULLETIN.)

R. E. Dillon, The Edison Electric Illuminating Company of Boston.—Throughout the eastern district of the country the bomb calorimeter is almost universally used for finding the heating value of coal. Where coal is bought on specifications the bomb is always used because the results by this method using mercury thermometers is correct to three-tenths of one per cent (0.3%).

No formula for working out heat values which makes use of the results of the approximate analysis will give an accuracy better than one per cent (1.0%).

Allegheny County Light Company Section, Pittsburgh, Pa.—Our coal has been purchased on specifications for the last three years. A systematic method of tests of all shipments of coal is employed and these tests are based on actual calorimeter measurements. In our opinion any empiric formula methods are unreliable.

23—32. We are endeavoring to ascertain the best method for dealing with accounts for wiring and material sold, and if it is advisable to record them separately from light and power charges, so that confusion in the consumer's ledger would be obliterated. Will member companies please give their system of dealing with this question and state if wiring and material items are included as arrears on light and power bills, and also in case of agreement to pay material accounts by installments, how should this be handled?

(Other replies in April BULLETIN.)

H. M. Edwards, Auditor, The New York Edison Company.—The New York Edison Company has one ledger account with each customer, and this account shows all his indebtedness, whether it consists of charges for current consumed, supplies sold or any other kind of indebtedness. We can see no advantage in keeping separate accounts with customers, whereas on the other hand, there are distinct advantages in being able to determine a customer's indebtedness quickly. Furthermore, if a statement of his indebtedness is rendered, it should be inclusive of everything, and this can most surely be done if a statement is made from one record.

Geo. W. Teffeau, Jr., Engineer, The Willimantic Gas and Electric Light Company, Willimantic Conn.—All accounts, other than for light and power, should be carried as merchandise charges. Unpaid merchandise or labor bills forfeit discounts on light and power bills, except on time payments which should be paid before a certain date; if not paid as per agreement then they are not subject to discount.

23—33. Do central stations draw load curves of their generator stations and substations from midnight to midnight? If not, from what points are the curves generally drawn?

H. P. Wood, Operating Engineer, Edison Electric Illuminating Company of Brooklyn.—It is the custom of this company to have all generating and substation curves drawn from 12 midnight to 12 midnight. Some of the large companies, however, make their curves from 7 a. m. to 7 a. m.

R. S. Hale, Boston, Mass.—Since 1894, the Boston Edison Company has been beginning its official day at 7 a. m., the day continuing until the following 7 a. m., and its load curves, etc., are drawn on this basis.

Formerly, the day ran from midnight to midnight, but the result of this was that when anything happened in the stations or on the lines after midnight it did not appear on the regular reports until the second day following.

By changing the starting point of the official day to 7 a. m., everything that happened during the night was placed on official reports, and this gave just about time for the transmission of these reports to the executive officers by 8.30 a. m.

A. G. Rakestraw, Contract Agent, Harrisburg Light, Heat and Power Company, Harrisburg, Pa.—We draw all station curves from 7 A. M. to 7 A. M.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—Yes, from midnight to midnight.

The Philadelphia Electric Company, B. Frank Day, Philadelphia, Pa.—The Philadelphia Electric Company bases all generating and substation data on exact day, midnight to midnight, and from the daily load curve we prepare an average load curve for true calendar month, and from the monthly curves we plot a curve which shows the average load for each hour of the year.

Harry Anderson, Statistical Department, The Commonwealth Edison Company, Chicago, Ill.—As far as I know the large central-station companies draw all their load curves from midnight to midnight, or enough of them do to make this the rule. In our own case this has been done since 1894.

I have seen some load curves drawn from noon to noon, but I believe this is only in special cases.

Alan Leslie Cary, Wilmington and Philadelphia Traction Company, Wilmington, Del.—This company plots load curves from midnight to midnight, and my experience has been that this is the general rule.

Allegheny County Light Company Section, Pittsburgh, Pa.—The usual practise of this company is to draw all load or performance curves from midnight to midnight of the calendar day. All station logs cover these hours, and charts from recording instruments are removed at the same time. This practise has the advantage of making reference easier, in that a curve of any given date does not overlap the preceding or following calendar day, thus avoiding the handling of several curves seeking information of a certain date.

23—35. What method is employed in keeping books on house wiring agreements where electric light companies advance money to contractors and then collect from consumers on the installment plan?

(See, also, answers to Question 23—32 in April BULLETIN.)

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—Several years ago when we did wiring, a regular lease or order was signed. Entry was made in the appliance department's ledgers, also in the petty ledgers. Full payment was made to the contractor and the monthly installment added to each month's current bill, the monthly bills passing from consumer's ledgers to the petty ledgers, where entries covering appliances were made.

A. G. Rakestraw, Contract Agent, Harrisburg Light, Heat and Power Company, Harrisburg, Pa.—I believe the best way to handle this is by the use of a card on which are entered the dates and amounts of payments due according to the terms of the agreement, with other necessary information. These are then filed in an ordinary "tickler box" under the date of the first payment. On that date a bill is sent to the customer, and the card moved ahead to the next date. When the payments are completed, the card may be permanently filed under the name of the customer.

Geo. E. Burns, Assistant Treasurer, The Commonwealth Edison Company, Chicago, Ill.—In answer to the above, our method in keeping books on house wiring accounts is to run a separate ledger and keep the accounts entirely separate from the consumers' ledgers.

We render a statement on the first of each month showing the amount of the installment which is due. This statement also shows on the bottom line the amount of the unpaid account, so that the customer is enabled to compare this amount with his books at any time.

The names and addresses are printed on these statements each month by our addressograph, it being only necessary to fill in the dates and amounts.

Some of our customers pay these installments with their lighting bills and others pay them separately.

23—36. What method is employed whereby a perfect check is made on meter constants entered in consumers' ledgers?

H. C. Schlegel, The New York Edison Company.—Upon entry of meter record on consumers' ledger, bookkeeper checks meter constant shown on meter charge slip against constant schedule, schedule showing constant applicable to the various size and type of meters.

Bill clerk in computing consumption upon bill is required to check constant used against constant schedule.

Meter indexer checks constant shown upon meter record against constant shown upon meter dial when taking first reading of meter.

Meter record slip is also checked against first inspection card issued by meter and testing department for all new and reconnected installations as to meter number, size, voltage and constant of meter.

The Philadelphia Electric Company, R. B. MacCreery, Philadelphia, Pa.—When a new meter is received from the manufacturer a shop test is made on same before it is placed in service stock; during this shop test the dial gearing is counted and constant determined and checked with that shown on dial face of meter. This data is in turn checked by a different man, and entry of same is made on Serial Index Card, which card serves as a history of the meter from this time on, entries being made on same when this particular meter is installed or removed from service.

Upon installing a meter in any premises a meter installation order made out in duplicate, by use of carbon sheet, is issued by the inspector in charge of the work, one-half of the order being given to the installer with the meter and the other half being retained by meter storekeeper, neither of these parts having any entries of meter data made at this time. The meter stock-keeper enters the data pertaining to size, kind, serial number and constant as shown on meter which he gives out, and meter installer enters same data on his half of order from meter he installs, both of these halves subsequently being returned to the inspector who issued order, who in turn on his final inspection of work removes a tag which was placed on meter at the time of shop test, which gives like data. The inspector compares these records and enters data on contract notice, and returns this form with the orders mentioned to the record clerks, who get out of the "Meters in Stock Index," the serial index card covered by meter installed. A consumer's meter record sheet is then made out, this form taking the place of the record in the consumer's ledger, all original billing being done from this sheet in meter department, and entry is made on same of serial number of meter, constant, date of installation, date fuses placed, etc. The constant data is checked at this time from information received from four separate and distinct sources, and any error would be easily noted, but to make this certain, we also hand the meter reader a reading card without the constant data entered and he must on his first visit to the meter mark in space provided on the card the constant data as shown on the meter dial, and this in turn is checked with record as shown on consumer's meter record sheet at time of computing first bill.

We have found this system as near a perfect check as is possible, very few errors appearing, but like all other systems, there is a factor of personal equation entering into routine of each man involved, checking the one from whom he receives his records and information.

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—I hand you below the procedure which we follow in checking meter constants:

QUOTATION FROM INSTRUCTIONS.

"The constant or multiplier of an electric meter *must be correctly* recorded in the consumers' ledger and on the meter reading slip, and to insure accuracy in this respect the following plan must be followed without deviation:

"One man of the present force should be appointed to the duty of obtaining correct meter data by visiting the customer's place immediately after the return electric service order is received at the office showing installation or set of meter. The standard card in use for recording meter data should be correctly filled out on the customer's premises as an original record.

"This card should be turned in to bookkeeper who will be responsible for the correctness of his ledger entry made from the return order and checked with the above mentioned card. The bookkeeper will have the custody of these cards, which will be subject to the inspection of traveling auditors, and he will be responsible for obtaining such a card properly filled out for each meter set.

"This data is not to be obtained by a man engaged *at the time* in reading meters or on other work, the intention being that this work is to be special and not to be complicated by attempting to do another line of work when engaged on this."

L. A. Coleman, Assistant Secretary, The United Electric Light and Power Company, New York.—The readings of all meters used by this company are obtained in kilowatt-hours and without the use of constants.

Douglass Burnett, Manager, Consolidated Gas, Electric Light and Power Company of Baltimore, Baltimore, Md.—At the end of each day's work of setting meters and connecting customers, a detailed record of installations and meters cut in is prepared, giving line order number, ledger, folio number, customer's name, location, class of current, company's meter number, type, constant, reading and location of meter, from which record the meter reader's ticket is made up, and which information is also entered on the consumers' ledgers on opening up the account. The meter constant is marked on the meter reader's ticket in

large figures in red ink, by means of a rubber stamp, so that no mistake should be made in determining the kilowatt-hours from the meter reading difference. On going to the customer's premises to take the first meter reading, the meter reader checks all of the above information and O. K.'s same, if found correct. In this way any possible error in billing from an incorrect constant is avoided

H. W. Cluthe, Edison Electric Illuminating Company of Brooklyn.—Meter constants are reported when meter sets are made on "daily connection reports" along with the type, number, etc. The constants on the reports must tally with the manufacturers' meter record. Meter readers are required to furnish, on dial slips, style, make, constants, etc., of all new meters set on consumers' premises Their reports are checked against the connection record.

The connection reports are recorded by order clerks, meter clerks and bill clerks, each of whom is furnished with a separate copy.

Bill clerks, in making out bills, compare their constant record with the meter and order constant records, so that when the bills are posted on the ledger there is small likelihood of there being an error of constants.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—All contracts and all meter constants are checked by a special man in the employ of the bookkeeping department. This party has access to all consumers' ledgers, orders issued, etc.

George Donle, Rochester, N. Y.—The present system employed by this company in keeping a check on meter constants entered in consumers' ledgers, and one which has given us no trouble since its adoption, is this:

There is a double check on the meter by the meter department before the report of such installation is received by the bookkeeping department. Our ledger sheets have two distinct columns in which the constant is noted, and it is not probable that the error would be made twice. Then again, the meter-read slip also shows the constant, and is copied from the meter order, which is also a check against the ledger. As all of our meters are tested within a period of six weeks after installation, the tests are entered on the ledger. The test slip also shows the constant, which is a further check. It will readily be seen that the chances for an error are reduced to a minimum. This system has been in vogue for years.

C. A. Dean, Head Installation Department, Cambridge Electric Light Company, Cambridge, Mass.—When meters are installed, the record is taken of number, size, constant, etc., by a man doing the work. Upon work order being returned to the office, this information is checked with card from meter index. Within one week from date of installation each service is inspected, and records, as previously, taken must tally with inspector's report. This method has proven sufficient to guard against errors so far as work and installation goes. From this point to the customer's ledger it is only a matter of the various clerks checking their figures.

24—43. Where company regularly inspects signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flat-rate outline and sign work, where competitive electric lighting companies are in the same field?

H. L. Parker, Illuminating Engineer, Consolidated Gas, Electric Light and Power Co., Baltimore, Md.—This company has a special maintenance contract for the care of electric signs. This maintenance is charged for at 1½ cents per socket per month on the sign. This includes painting all metal parts with metal paint once a year, painting the lamp letters, border, etc., once a year, and touching up lamp borders and gold leaf borders, etc., once a year with paint same quality as found on the sign. The body of the sign to be touched up if scratches or mars expose metal to the weather. All lamp letters are washed or cleaned twice per year in addition to the one painting.

Flashers or flasher motors are kept in repair and flasher or motor is loaned to customer to keep the sign in operation while customers own apparatus is being repaired.

This price has nothing to do with the maintenance of lamps, as the company's flat rate sign lighting contract is made for furnishing current, lamps and lamp renewals in signs. At present the company has no flat-rate or maintenance contract for outline lighting and have made no definite provisions nor established a policy for rating or maintaining outline lighting.

24—46. Since the recent hearing before the Interstate Commerce Commission, the papers and magazines have been full of the doctrine of efficiency or scientific management, implying, in general, that in many cases by scientific planning, employes as individuals and the organization as a whole, can accomplish more work with less expenditure of time and effort, thereby enabling individual wages to be increased, and yet a saving effected to the corporation.

Assuming for the sake of argument that scientific management, so-called, can accomplish a large part of what is claimed for it in industrial establishments, and even in railroads, is there any opportunity to effect a similar saving in electric light and power companies?

(Also answered in March and April BULLETINS.)

Geo. W. Teffeau, Jr., Engineer, The Willimantic Gas and Electric Light Company, Willimantic, Conn.—Depends on conditions. Since the conditions are not known it is pretty hard to give an intelligent answer. Experience teaches that a workman's efficiency is in direct proportion to his satisfaction and ability and in inverse proportion to poor conditions and poor leadership.

24—52. If a customer's meter tests 10 per cent fast, at 1-10 load, and O.K. at 3-4 load, upon what basis should a rebate be made to the customer? Have any of the State Commissions ruled upon this question?

(For other replies see April BULLETIN.)

C. S. Jennings, Rochester, N. Y.—We have adopted the following system in making adjustments on all fast meters:

Ampere		Volts		Standard Watts		Efficiency of Meter		Metered Watts
1	×	115	=	115	×	1.10	=	126.5
7.5	×	115	=	862.5	×	1.00	=	862.5
10	×	115	=	1,150	×	1.00	=	1,150
				2,127.5				2,139.0

$$2{,}139 \times 100 = 213{,}900$$

$$\frac{213{,}900}{2{,}127.5} = 100.5 \text{ — Efficiency of Meter.}$$

A rebate is made according to the above formula in all cases except where the consumer is using either the light or full load during the entire period for which the adjustment is made. In cases of this kind, the adjustment should be made on the actual percentage found on this particular load. We determine this by taking into consideration the kilowatt-hours consumption, the class of business, and the hours' use per day.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—We should settle case cited on basis of the per cent meter was fast at "service" load, or in other words should test meter on load which was principally used by customer, and if this could not be accurately arrived at should give customer the benefit of maximum per cent that meter was fast.

The following letter speaks for itself:

"John S. Kennedy, Secretary, State of New York, Public Service Commission, Second District, Albany.—We note in the BULLETIN of the Association for April, 1911, a statement by Mr. Laurent Heaton, of the Orange County Lighting

Company, Middletown, N. Y., in answer to question 24—52. Mr. Heaton gives a number of rules for checking complaint tests and states that 'the following are rules of the Public Service Commission, Second District, of New York State.'

"Mr. Heaton's answer is misleading in that this Commission has not established any such rules as are given. We believe that the rules given are those of the Public Service Commission for the First District, which has jurisdiction over Greater New York only.

"In view of the fact that your BULLETIN has a wide circulation among electrical operating men, we believe that you should take steps to correct this misunderstanding."

24—53. Assuming that a company expended $100,000 per annum in its sales department for the promotion of its business, what is the minimum amount of annual revenue secured that would justify the expenditure?

R. M. Searle, Rochester, N. Y.—If a company spent $100,000 per annum and secured $100,000 worth of gross earnings each year, they would have secured business that was cumulative, and if they secured this amount of business in a year, they would be justified in spending $100,000 a year, considering the cumulative effect of the business obtained, it being assumed that the $100,000 of gross business per year obtained through this department was the actual results of the efforts of the department. $100,000 a year gross earnings through the efforts of the department would be the minimum that would be justified.

24—55. Do any of our member companies maintain a separate department or employment bureau for the purpose of receiving applications and keeping up a live eligible list of applicants for all classes of work in the service?

James C. Doty, Chief Clerk, Pay Roll Bureau, Edison Electric Illuminating Company of Brooklyn.—We do not maintain a separate department for the receiving of application cards. All persons seeking employment with this company fill out application cards which are filed with the department to which the applicant's service would apply.

The Philadelphia Electric Company, B. Frank Day, Philadelphia, Pa.—The Philadelphia Electric Company has a card system for applications for positions. Cards are filed alphabetically under name of applicant. Also cross-indexed under "Position" classification, and where there are special recommendations are again cross-indexed under name of recommender.

Applications for positions are filed at the office of the paymaster, for use as occasion demands.

Joseph Williams, Treasurer, New York Edison Company.—The payroll bureau receives and acknowledges all applications for employment and files the same for reference in case vacancies occur. Applications are filed according to the character of the work applied for. In addition a card index is maintained giving the names of all applicants arranged alphabetically. These records are retained for a period of from eight months to one year.

24—56. How many of our member companies keep a complete card index record of all past and present employes which may be referred to in answer to questions regarding past and present employes' ages, nationality, education, previous experience, salary, grade, and general record while employed by the company?

The Philadelphia Electric Company, B. Frank Day, Philadelphia, Pa.—The Philadelphia Electric Company has a complete card record of former and present employes. The employment authorization card covers all necessary detail information, as to name, address, age, position, date of employment, department, rate, former employment, recommender, etc. This card becomes a *record card* of all changes in rate or position, and upon employe leaving service, date and reason are entered on the card, which is then transferred to file of *former* employes for reference. Upon any subsequent re-employment the record of previous service is recorded upon latest authorization card, so that the active card covers the record of previous service in the company.

James C. Doty, Chief Clerk, Pay Roll Bureau, Edison Electric Illuminating Company of Brooklyn.—Yes, we have kept such a record since 1906.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—A card index is maintained by this company, especially in connection with the commercial department.

Joseph Williams, Treasurer, New York Edison Company.—The payroll bureau maintains a card index file of all present and former employes, giving a complete record of their service with the company and also a copy of the information obtained on their original applications.

24—57. What experience have member companies had in keeping a partial or complete photographic record of all employes?

James C. Doty, Chief Clerk, Pay Roll Bureau, Edison Electric Illuminating Company of Brooklyn.—Identification cards bearing photos of the employes are issued by this company to all employes who come in contact with customers or outside parties where proof of their employment by the company is necessary, such as collectors, meter readers, inspectors, meter testers, etc. A record of cards issued, with a copy of the photo on original card, is kept by the pay roll bureau. These cards are issued the first of each year, are numbered and bear the company's seal.

The Philadelphia Electric Company, B. Frank Day, Philadelphia, Pa.—Would question the value of photographic records, inasmuch as styles change in whiskers as in other "clothes," and beauty, the poet tells us, is ephemeral, even for employes of lighting companies; also because if photograph was taken when employe had his "working clothes" on, his friends might not recognize him in his "glad rags."

Joseph Williams, Treasurer, New York Edison Company.—The payroll bureau arranges for the photographing of all employes to whom identification cards are issued and retains copies of these photographs on the identification card receipts. The contract and inspection department maintains a complete photographic record of all employes in that department, this file being kept in the department office. All photographs are taken by the photographic bureau and all negatives are retained by them.

A. E. Evans, General Operator, The Commonwealth Edison Company, Chicago, Ill.—The substation department has each man furnish a photo when he is employed.

24—58. Do member companies compel applicants for positions in the electrical departments to undergo a physical examination, and if so does the applicant or the company bear the expense of same?

James C. Doty, Chief Clerk, Pay Roll Bureau, Edison Electric Illuminating Company of Brooklyn.—A physical examination of persons seeking employment in the electrical department or any other department of the company is not required. Each head of department is instructed to give personal attention to the health of his employes and advise them to consult the company's physician when he thinks conditions warrant.

The Philadelphia Electric Company, B. Frank Day, Philadelphia, Pa.—Practically all employes of the Philadelphia Electric Company make application for membership in the Beneficial Association, and the examination of the medical director would indicate any physical defects, and, if sufficient to interfere with the proper and safe performance of duty, he would not be permitted to enter upon hazardous duties. This examination is made by the Beneficial Association and without any expense to the applicant.

24—59. How many member companies are making allowances to customers where meters are found fast on routine test? If allowances are made, full detail regarding period covered by rebate will be appreciated.

George H. Whitfield, General Superintendent Light and Power, Virginia Railway and Power Company, Richmond, Va.—In the event that any test of the customer's meter made by the company's inspector shows that the meter is running fast by 5 per cent or more, a rebate is allowed on all bills since the last test, on the basis of one-half of the error.

E. A. Barrows, Treasurer, Narragansett Electric Lighting Company, Providence, R. I.—This company has, for some time, been making allowances to customers whose meters have been found fast on routine test. Tests vary in frequency, with conditions, size of meter, etc., and allowances are made back to the last recorded test. The customer is then notified by form letter of the fact that his meter was found fast, stating the percentage and the amount of deduction, in kilowatts, which deduction is made in kilowatt-hours on the next bill rendered him.

The Philadelphia Electric Company, H. M. Simpkins, Philadelphia, Pa.—We adjust a bill if it is shown that the meter has been registering either fast or slow; considering that a five-per cent discrepancy at the average load warrants our giving the consumer adjustment on the bill. If this discrepancy is in excess of five per cent, we have our representative make personal explanation to consumer in such cases, and show the consumer where the proper credit has been allowed. In case a meter fails to register, and in cases where a meter is shown to have been slow, we render a bill on the basis of an average bill, as called for in our contract, under the following clause, viz.:

"In case during any period a meter ceases to register the full amount of current consumed, the amount of the bill will be estimated by averaging the amounts registered for the periods immediately preceding and subsequent to the same," and present bill to the consumer with personal explanation as to the method by which the bill was computed.

All of the above adjustments are only allowed on bills for the current period, and no allowances are made on back bills under the above circumstances.

F. J. McCormack, Edison Electric Illuminating Company of Brooklyn.—Our custom is, on periodic tests, meters recording over 4 per cent fast, to allow the customer's account the percentage fast for one-half the period since last test.

Douglass Burnett, Manager, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—We do not make it a practise of making allowances where meters are found fast on routine test, but if the meter department on making routine tests, finds a case which they consider of such irregularity as to warrant the attention of the complaint department, such matter is referred to them, and allowance may be issued if deemed advisable. If test is made at the request of the customer, meter is considered correct if within 4 per cent of accuracy, and any allowance that is made on meters, if more than 4 per cent from accuracy, is made to cover the period which investigation shows to be correct, but in no event is an allowance made over three months, and in most cases one month is the period covered by the allowance.

O. M. Rau, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—On routine test any meters found fast beyond the 4 per cent allowed by the railroad commission, a rebate for a period of three months is allowed to the customer for the amount meter was found fast, unless there was a test made prior to the three-months' period, under which conditions the rebate is allowed up to the time of the last test.

O. H. Hutchings, The Dayton Lighting Company, Dayton, Ohio.—We do not make an allowance to our customers whose meters are found fast on routine test, neither do we ask customers to pay us an additional amount where we find their meters run slow.

Our experience has been that where meters receive the attention they should, errors of any consequence are by far the exception.

If the customer requests a test of his meter, a complete report is made as to its condition as found, also as left, a copy of such report being placed in his hands. Adjustments are made with the customer should his meter show an appreciable error as the result of the special test.

A. D. Spencer, The Edison Illuminating Company of Detroit.—This company allows rebates on meters found more than 4 per cent fast on routine tests, unless the previous condition of the meter, as shown by earlier tests, indicates that the recent over-registration has been offset by a former under-registration.

In determining the over-registration, the accuracy on light load, the accuracy on heavy load and the conditions of use are taken into consideration.

Rebates are made to cover one-half the period following the previous meter test, except when it is possible to determine the period of over-registration by inspection of billing records, etc.

In all cases, when the amount of over-registration is considerable, the customer is consulted before making adjustment, and settlement satisfactory to customer is made.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—Allowances are made for not more than six months' period. All allowances are based upon the percentage fast in excess of accuracy ratio of the meter.

24—60. Where central stations take flat rate sign or window lighting contracts, how are installations turned on and off, by patrol or clock switch? If the latter, what make or type of clock switch is used and has it worked satisfactorily? What troubles have arisen? Also, if clock switches are not used, how are customers who do not care to avail themselves of a "dusk to midnight" schedule, but want their window lights, for instance, turned off at 9.30 or 10 o'clock, taken care of?

The Philadelphia Electric Company, E. S. Pelling, Manager Electric Sign Department, Philadelphia, Pa.—In this city, we have a large number of consumers who are using time switches to turn on and off the current for their electric signs and window lighting. So far, they have had good results.

The various types of time switches used here are made by the following concerns:

Albert and A. M. Anderson, Boston, Mass.
Balbow-Hutchinson, Providence, R. I.
Hartford Time Switch Co., 101 Warren St., N. Y.
Reading Automatic Time Switch Co., Boston, Mass.
Acme Switch Co., Hartford, Conn.
The Cleveland Dental Manufacturing Co., Cleveland, Ohio.

We also have a few consumers who engage a night watchman, in the neighborhood in which their store or electric sign is located, to turn on and off the current, paying about twenty-five or fifty cents per week. Under this arrangement, usually the window lighting and electric signs in front of stores are turned on by the merchants before leaving, and then, of course, turned off at stipulated times by the night watchman.

This company has no flat rates for electric signs or window lighting.

H. L. Parker, Illuminating Engineer, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—This company makes flat rates for sign lighting. Our contract forms provide that customers shall furnish, at the company's option, either wiring and a hand-operating switch or wiring to provide for a time switch furnished by the company. No time switches are used for the reason that they cannot always be installed on the inside of the customer's premises at a convenient point. So far, the company has not found a time switch that would operate successfully if exposed to severe climatic changes. As a result all flat-rate sign lighting is controlled by a hand-operated switch, using company's patrolmen.

Our flat-rate contract provides for three schedules:

One from dusk to 11 P. M.
One from dusk to 12 P. M.
One from dusk to 2 A. M.

This arrangement seems to take care of most of the business possible to secure on a flat rate.

L. F. Philo, Sales Manager, Union Electric Light and Power Company, St. Louis, Mo.—This company supplies no flat-rate lighting, this class of service being handled by three local sign companies to whom we sell current at regular meter rates. They are using the Anderson time switch and state that it is giving excellent satisfaction with practically no trouble.

E. A. Mills, The New York Edison Company.— This company does not take sign or window lighting on a flat rate at the present time. Some time ago, however, we had a proposition installing panel signs on a flat-rate basis, operated through time switches. Several different makes of standard time switches were used and more or less difficulty was experienced, although the switches were calibrated before being installed. Owing to varying conditions, operation was not very accurate or satisfactory; the result was constant complaint from the customers. Where the time switches are not used, perhaps the best system to adopt is that of placing a switch accessible from the outside to be turned on and off by a patrolman. This is undoubtedly the best and most economical system in the long run.

R. R. Young, Division Agent, Public Service Electric Company, Newark, N. J.—The flat rate on sign lighting in effect over our several districts includes the control of the hours of burning by the patrol system.

We have used some clock switches, but their unreliability has compelled the substitution of the patrol. If a customer desires to light his windows it is necessary for him to install, at his own expense, a clock switch, as we have no flat rate on window lighting.

Fred E. Schornstein, Richmond Light, Heat and Power Company, Richmond, Ind.—Where central stations take flat-rate sign or window-lighting contracts the most satisfactory method of turning on and off the installations is by patrol. It would not pay a central station to have more than one time set for the patrol to turn on and off such installations, and therefore customers who do not care to avail themselves of the dusk to midnight schedule, but who want window lights and signs turned off and on at some time other than the time of patrol, should provide their own method of turning on and off. An ordinary alarm clock attached to the switch seems to be, up to this time, about as satisfactory as any for this purpose. It should be the aim, of course, of the central station to show the customer that he cannot afford to turn his installation on later nor off earlier than the time of the regular patrol.

Thos. W. Peters, Commercial Agent, Columbus Railroad Co., Columbus, Ga.—We have a regular flat-rate sign and window contract which states that the service is to be turned on at dusk and turned off at 11 P. M., except on Saturdays, when it shall burn until 12 P. M. This service is turned on and off by our regular patrolmen, and we do not take any service which is to be turned on and off at other hours than that specified in the contract.

F. L. Ball, Manager, Haverhill Electric Company, Haverhill, Mass.—Our flat-rate sign and window-lighting installations are turned off practically in every instance by a patrolman. Our business section happens to be so compact that this can readily be done.

We have a few customers who have installed time clocks, and all our patrolmen have to do in this case is to make sure that same are being turned off at the proper time.

We have had some trouble in the matter of flat window rates on account of the customers turning their lights on before there is any need, and also in some cases we find that they sometimes turn the lights on after same had been turned off for the purpose of trimming windows, or something of the kind.

We instruct our patrolmen to report very carefully any violations of the contracts which come to their attention.

We also place an acid mark upon each one of the lamps installed so that we may make sure that all lamps that are exchanged are flat-rate window lamps.

We also request our customers to allow us to install the lamps ourselves.

We find that we had rather do this than deliver the lamps to them, and in this way make sure that all lamps delivered are absolutely installed in the proper locations.

In regard to the last paragraph of this question, would say that we only take on flat-rate customers for a ten, eleven or twelve o'clock basis. In this way all flat rates are turned off at one of these three hours.

C. R. Hayes, Manager, Fitchburg Gas and Electric Light Company, Fitchburg, Mass.—This company has nearly 100 flat-rate sign and window tungsten light contracts. The installations are turned on at a reasonable time by the customer, while our patrolman turns them off as soon after the time contracted for as is possible. This service is offered only on the basis that the light shall be burned until 10 P. M.; Saturday nights, 12 P. M., with the exception that a number of contracts have been taken for 11 P. M., rather than 10.

We have found it possible to demonstrate to the storekeepers the advantage of uniform burning and its effect on the general lighting of the streets, as well as the desirability of burning the regular schedule of hours which was formulated in response to a request from the Merchants' Association.

Ross B. Mateer, Power Expert, The Denver Gas and Electric Light Company, Denver, Colo.—All installations operating from dusk to midnight are turned on and off by a patrol. We make no flat-rate contracts for 9.30 or 10 o'clock lighting. All contracts must be until midnight or all night.

S. Fred Smith, Manager, Salem Electric Lighting Company, Salem, Mass.—It has been the practise of this company up to this time for our patrolman to turn off sign and window lights at such times in the evening as our customers have indicated to us, and so far, we have used no time-clocks whatever. As we have only a limited number of these customers, say twenty-five or so, it has not been inconvenient for our patrolman to turn off these lights at such time as our customers have desired. Of course, in every case, it has not always been possible to turn them off exactly on the minute, but we confine ourselves to the schedule as closely as practicable. In some cases, the customer has had the benefit of a little longer service, but this is inconsequential.

L. W. Layman, Rochester, N. Y.—We have no flat-rate for window or sign lighting. Most of our consumers use time switches of various makes, the A. & W. being most generally used.

Geo. S. Pearson, The Denver Gas and Electric Company, Denver, Colo.—Our flate-rate sign and window lighting installations are turned on and off by patrol except outside of the business district, where clock switch is used. Our experience has been very satisfactory if the clock is taken care of and wound up regularly. We sell all of our flat rates on a dusk to midnight schedule.

J. T. Day, Superintendent, Malden Electric Company, Malden, Mass.—On flat-rate sign and window lighting, we use both the patrol and clock switch systems. In the latter case, we use the Anderson Time Switch, which has worked very satisfactorily with the exception of the first few installations—when we had more or less trouble with the springs breaking, which I believe was caused by winding the clocks too tight. When clock switches are not used, our patrolmen turn off the lights according to the different schedules.

C. A. Dean, Head Installation Department, Cambridge Electric Light Company, Cambridge, Mass.—We have several sign services which are on flat rate, based on our contract rate and on which we furnish clock switches. These time switches are manufactured by Albert & J. M. Anderson of Boston, and have given good satisfaction. Several are equipped with the Sunday cutout attachment. We wind and inspect the clocks once each week and have had no trouble.

P. J. Smith, Superintendent, Arc Lamp Department, The Commonwealth Edison Company, Chicago, Ill.—Our flate-rate signs and window lighting are turned on and off by switches, with the exception of some that are too remote from the nearest switching route. In these places we install time switches (bought from the Albert & J. M. Anderson Company, of Boston). We avoid the use of time switches as much as possible for the reason that hand switching is more reliable and less expensive.

Some of our flat-rate business is turned off at 10.00 p. m. and some at 12.00 p. m., and customers desiring lights turned off at other hours are accommodated, if it is possible for man in that district to reach them without interfering with his regular work.

25—10. What states have statutes giving the right of eminent domain to power generating and transmission companies for pole lines? Is there available a pamphlet or book containing copies of all existing statutes covering this point?

(Also answered in March BULLETIN.)

H. G. Kislingbury, Union Electric Light and Power Company, St. Louis, Mo.—Wisconsin Statutes, Chapter 662, 1907, covers condemnation of land by telegraph, telephone, power and light companies.

Section 1778 A, Part I. (electric lines crossing railroads; condemnation) is as follows:

Condemnation proceedings may be instituted for the taking by such corporations mentioned in Section 1778 of rights, interests or ownership in any lands, or over bridges and streams, and any land on or within public highways, * * * over, upon or beneath which that line or system is, or is to be constructed or located, either by the corporation or any person interested in the land. They shall be commenced by petition to the Circuit Court or a Circuit Judge of the county in which the land lies.

Part II. Petition.—The petition may be signed and verified in the same manner as pleadings in the Circuit Court, and shall contain the following in substance: The land suitably described * * * along which, underneath or over which the line * * * is to be constructed by running wires * * *; that it intends in good faith to use such real estate, and it is required for its use; if made by another, that it is used or is designed by the corporation to be used for telegraph or telephone purposes or for the transmission of power, heat or electric light for public purposes.

Section 1778 D, Part I. Electric line companies; condemnation; appraisals.—Upon request of the corporation or any person interested in the property described in the petition, the Commissioners appointed in a manner hereinbefore mentioned shall proceed with the performance of their duties and may adjourn the proceedings, but not more than twice nor more than sixty days in all as to any one case.

Part II. Notice.

Part III. Appraisal.

Parts IV. and V. Poles.

The Commissioners may, in case of dispute, determine the places along said line in which the poles may be set or pipes or conduits laid. In no case, except where the owner consents thereto, shall poles be set in front or upon any residence property or in front of a building occupied for business purposes, unless the Commissioners shall find that the same is necessary.

Part VI. Location.

After the condemnation proceedings have been completed, the Court may still determine as to the necessity of the location and as to whether such line or any pole or fixture thereof might be removed to some other point or place.

Part VII.—The Commissioners shall, within twenty days after the last viewing of the property so taken, make and file in the office of the clerk of the Circuit Court a report of their proceedings concerning such property, etc.

Part VIII. Compensation.—The Commissioners shall be entitled to such compensation as the Court may direct, which shall be paid by the corporation taking any of the above incorporated lands, rights and easements.

The Railroad Commission of Wisconsin has published a small bulletin containing a *compilation of laws affecting the regulation of public utilities.*

NEW QUESTIONS

0—37. Do any member companies have "blown" fuses refilled, and if so how do they assure themselves that work is properly done? Are there any concerns that refill fuses with the approval of the Board of Underwriters?

0—38. We have a customer who is asking us to furnish the steam and water necessary for operating his laundry, but in the absence of data or any information which might be obtained locally, we hesitate to make a figure to this party for this service. Are there any member companies which are furnishing steam and water for heating and washing and doing all kinds of laundry work in laundries located adjacent to their plant? If so, any information or figures will be appreciated.

0—39. What comparative experience have member companies had with the two methods of resuscitation from electric shock, and what is the advice of medical men regarding the advantages of the so-called prone method and the method of laying the person on his back and working his arms to induce respiration?

1—10. What is the best kind of paint for our stacks, gas holders, and water stand-pipes? We have had experience in painting stacks and pipes, only to find the result unsatisfactory and the work to do over. Also is it wise to paint the inside of a smoke stack before erection?

4—4. On what slope (minimum) will slack coal run? Does slope vary for open or closed chutes?

7—7. Will some member company, who has low-pressure turbines, kindly furnish some data on the following proposition:

If a reciprocating engine and generator carrying 3200 kilowatts with a 28-inch vacuum takes a water rate of 18.9 pounds per kilowatt-hour, what would be the water rate if a low-pressure turbine was connected to the engine, exhaust vacuum remaining the same, and the engine-driven generator delivering its full 3200 kilowatts and the low-pressure turbine delivering approximately 2000 kilowatts?

7—8. Will member companies who have Parson's Type Turbines kindly give experiences they have had with steel blading and with steel, copper-plated blading, also, member companies who have Curtis Turbines give experiences they have had in regard to trouble with nozzles and blading corroding?

10—46. Will it be possible to obtain a light or get a reading of voltage between the phases of two alternating-current machines which are not tied in together on a system, machines being 3-phase, 4-wire type? Why?

10—47. If the oil switch on the alternating-current side of a rotary converter opened as the result of a surge, or other reason, and the direct-current switches opened, would there be any bad effects from throwing the oil switch in again before the machine slowed down appreciably, without any further changes, such as pulling the field switch or throwing the alternating-current switches to the starting tap of the transformers?

10—48. It is desired to supply 110-220-volt electrical energy for lighting from one generator. Under what conditions should

1. A 3-wire generator be used?
2. A 2-wire generator and a balancer set?

11—21. What has been the experience of member companies regarding the uses of varnished cambric for insulating high-tension cables?

What voltage do you use it on?
What is the temperature of the air where it is used?
How many years have you had it in service?
Do you cover it with lead or with braid?
Have you ever had any trouble with varnished cambric cable?
How does it compare in durability with good rubber when exposed to the same conditions of load and external temperature for the same number of years?

12—50. What methods do member companies use to supply combined light and power from a three-phase circuit, where the use for lighting is above the limitation for a single-phase circuit?

12—51. What method of lightning protection has been adopted by members who are now employing 11,000-volt to 110-volt distributing transformers on 11,000-volt transmission lines? What success have member companies had with this method of distribution? Our line runs through a level country, but we are subjected to severe lightning storms, the path of these storms being diagonally across our line through practically its entire length of twenty-five miles. The object of these transformers would be to supply farmers and one or two small villages along this line.

12—52. Do any member companies give their linemen's rubber gloves any test before issuing them for service? Do any buy linemen's rubber gloves under any specification, and if so, would like to know what points are covered?

13—24. What rules are member companies pursuing in regard to bending of high-tension lead-covered cables, and approximately what proportion of cable faults occur at bend?

13—25. Have member companies had experience with the scheme by which arcing grounds in cable or overhead lines are eliminated by means of single-pole automatic switches connecting phase in trouble to ground by means of relay in case arcing ground is started, thus eliminating the effect of the arc in either burning cable and causing dead short, or breaking down insulators in case of overhead lines?

14—8. Have any of the member companies purchased Gould storage batteries? If so, what capacity, and are they for peak or stand-by service?

15—57. In a transformer station with two step-down transformer banks, one 1200 kilowatts capacity and one 400 kilowatts capacity, Westinghouse oil-cooled transformers, connected in parallel on 6600-volt, three-phase, 60-cycle system, using Scott connection, transforming to two-phase, 2200-volt, four-wire:
When banks are tied in together either on 6600-volt end or 2200-volt end, at times we get dips of from 2 to 15 volts on lighting system.
What causes these dips, and can same be remedied?

15—58. What experience have member companies had with three-phase transformers? Do the advantages of space, economy and cost more than counterbalance the disadvantage of a complete shut-down in case of trouble?

18—6. Wanted:—Information in regard to electric heating devices for incubators.

19—53. Can any member suggest a method of locating the trouble in the following motor installation?
A three horse-power shunt wound, direct-current motor was connected to the line through an Allan-Brady starting rheostat, as per diagram. When the switch was thrown in and the starting arm moved slowly to cut out armature resistance, the motor refused to start.. By giving an energetic pull on the belt at the same time the motor started, but extreme sparking occurred on the commutator. As soon as the starting arm reached its maximum travel, thus cutting out all external resistance, the sparking ceased, and the motor operated under normal conditions. Excessive heating also occurred in the external resistance during period of starting.

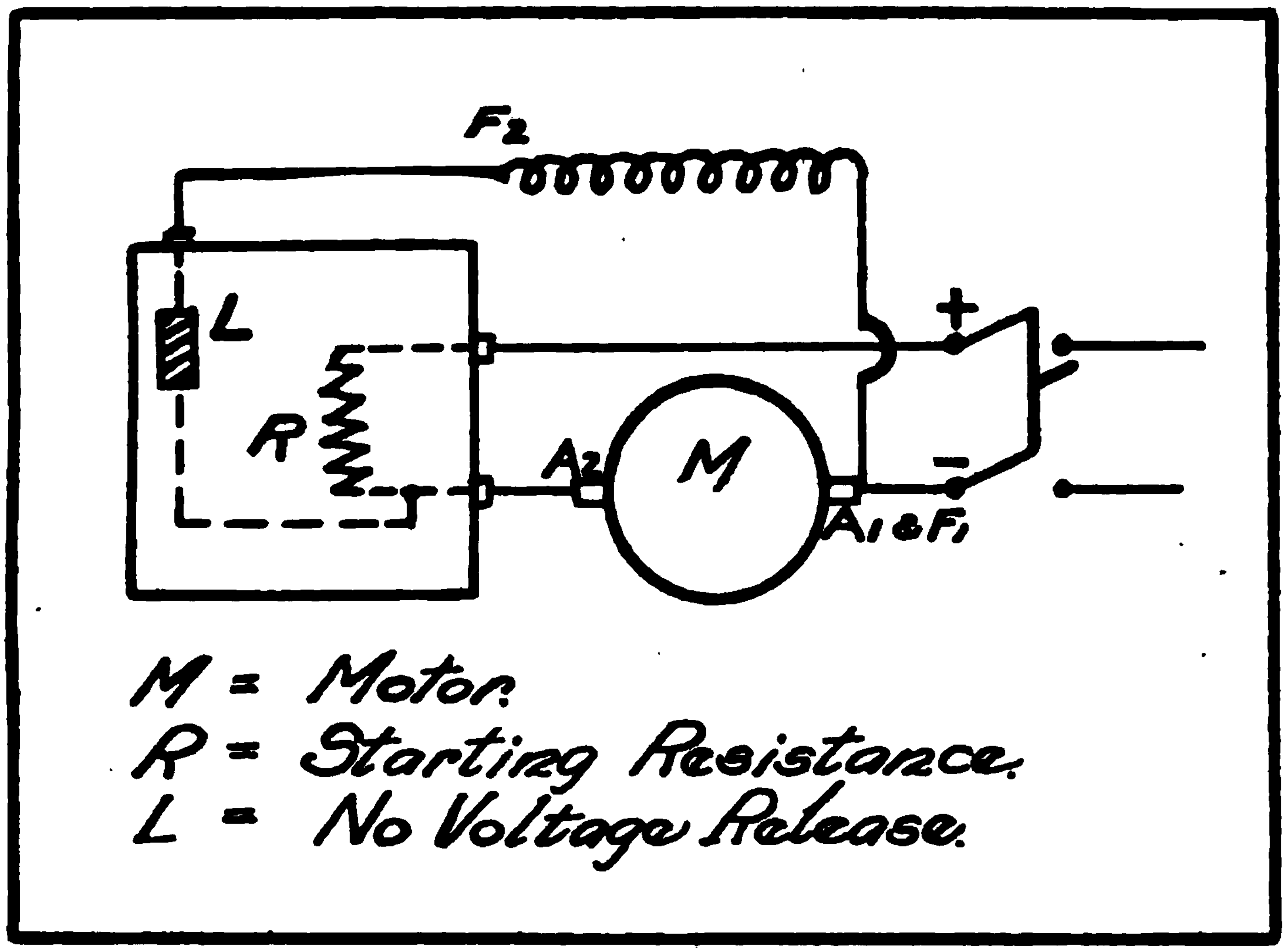


Diagram referred to in Question 19—53.

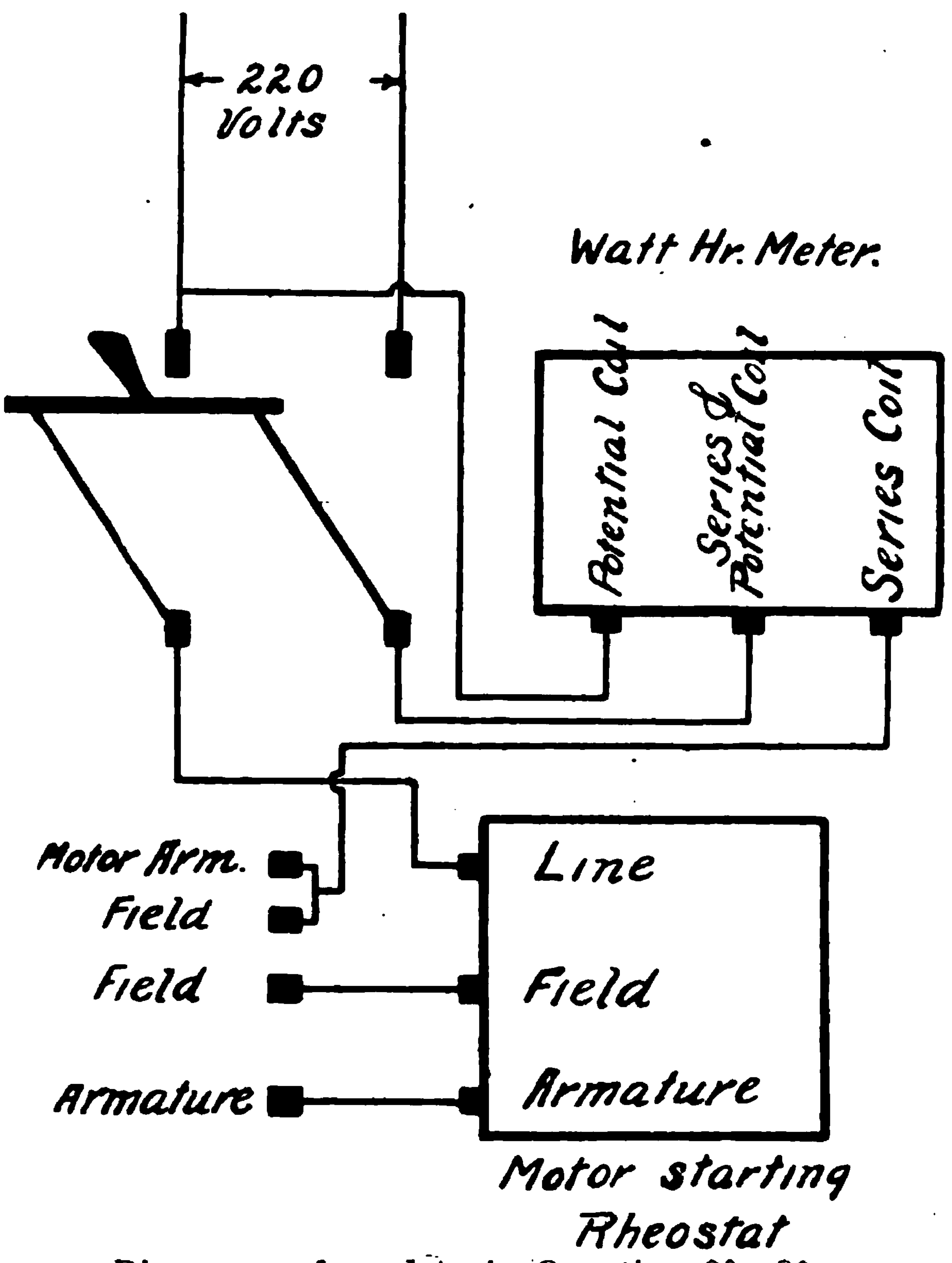


Diagram referred to in Question 20—80.

20—79. We have a customer whose installation calls for a 100-ampere meter on a single-phase, 110-volt, lighting service. Which would be the best, to install a 100-ampere meter or to install a 100-ampere, 20 to 1 ratio, current transformer, with five-ampere secondary windings, and a five-ampere, 110-volt single-phase meter?

The above proposition is one that is of great interest to us, and before deciding on just what course we wish to follow on services of the above mentioned size, we would like to know what the opinion of others is regarding same.

20—80. Please explain the advantages and disadvantages of connecting meter as shown in the diagram; also show best way to connect up such a meter. Why will you receive a shock on touching the motor commutator with connections as shown?

20—81. Would like an expression of opinion from member companies who have used diamond jewels in direct-current meters as to the advantages of the results obtained over the use of sapphire jewels, the difference in price being considered.

20—82. What experience have member companies had relative to the installation of meters outside of consumers' premises, and what are the advantages and disadvantages attending such practise? What is the most approved method of installation in order to render the meter accessible to meter readers, meter testers, and to facilitate inspection to determine whether service wires have been reversed between pole and meter subsequent to installation, thereby making it possible to ground the house wiring and cut out the meter?

22—52. What are electric light companies receiving from municipalities having a population of three to five thousand for tungsten street lights. I would like to have this information in 40, 60 and 80 watt sizes if possible, to get a line on the prevailing rate being paid, especially in New York State, for this class of service.

23—37. What practical benefit results from the keeping of a perpetual inventory? To within what percentage of being correct has experience proved a perpetual inventory can be kept?

23—38. How do large companies handle their scrap and spliced wire, and what method is used in accounting for same?

23—39. Please advise us how many kilowatt-hours there are in the term kilowatt-year.

23—40. Is it or is it not good practise to eliminate meter readings from monthly electric light and power bills so that bills only show the net kilowatt-hours, rate and amount in money? What companies now practise this method?

24—61. What member companies hold regular meetings of their employes or department heads?

24—62. Will member companies having mutual aid or benefit societies kindly advise what percentage of the available employes are members of such society?

What contribution, if any, do the member companies make towards the funds of these societies?

What are the monthly dues per member?

What is the amount of sick and death benefits paid?

Is the sick benefit limited to certain period of time each year?

Does the society refund any portion of the dues to members who sever their connection with the company, or are members leaving the company allowed to retain membership in the society by paying their dues regularly?

24—63. Has any member company experience with more than one kind of addressograph? If so, which one gives the best results? We require a new one almost at once. Number of accounts struck off daily, 1500, and a daily average change of 45 names and addresses.

24—64. Have any member companies made any attempt to introduce the Taylor system of scientific management into any department of their power plants, or any other department of their organization; if so what have been the results?

Repeated Questions

The following recent questions have received no reply or else it is felt that further replies are called for and would be of value. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

3—8. Will engineers of large central-station systems who are using the "dry tube" surface condensers (mentioned in the Proceedings of the National Electric Light Association, of 1909, page 105) give information concerning same as to whether any drawbacks have been encountered since they were installed, whether they are actually giving the results that were mentioned in connection with the article quoted, and whether higher vacuum can be maintained by this condenser under similar conditions than with the standard condenser without the "dry tube" addition.

12—47. If all the station output of single-phase, 2300-volt, 60-cycle current for incandescent lighting is metered at the station and all the customers are on meters, in a town of 5,000, what proportion exists in actual practise between the total consumption as indicated by the customers' meters and the total output of the station as indicated by the station meter? In general, what per cent of the loss is chargeable to line, transformers, meters—what else?

12—49. Do member companies find it practicable to have linemen's hatchets equipped with a leather thong or rope to slip over lineman's wrist while he is using hatchet at work on pole above ground, in order to prevent injury to persons on ground should hatchet slip from his hand?

13—15. Have any member companies had any experience with a device known as the Wireless Cable Tester and Trouble Finder, and if so what are the results?

13—23. What would be the best method combining quality and cheapness of connecting temporary street illuminations from an underground system in which no poles at all are used, consumers' taps being taken from service boxes under the sidewalk? Cables, lead-covered, run in tile conduits. There are iron poles for trolley wire construction.

14—7. Have any member companies had any experience with the Edison Battery for vehicle work? Would certainly appreciate any information we can get on this subject.

15—55. Has any member company experienced trouble, while operating in parallel banks of three transformers, connected three-phase, by having one bank take more than its correct proportion of load, due to unbalanced voltage? If so, what measures have been taken to overcome the difficulty?

15—56. Kindly explain as to the method of checking the ratio of current transformers on high voltage in central stations. Kindly give data, etc.

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40 and 80 watt tungsten series lamp.

16—41. What experience, if any, have member companies had in the use and installing of the 400 and 500 watt Mazda units, as to life and methods of installing?

16—42. What experience have member companies had in regard to burning 250-watt tungsten lamps on an angle of 45 degrees or greater?

20—76. Will some member company give information in regard to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

20—76a. What has been the experience of member companies with the new 25-cent prepayment meter? What is the average monthly revenue per meter? What do you figure must be secured as the minimum revenue per meter before the installation of this meter pays?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

21—27. What member companies have solicitors working exclusively on electric sign business?

In answer mention population, also if the results have been satisfactory, the cost and yearly income per 50-watt equivalent.

21—28. Would like to get from members data on heating different kinds of buildings, as we find this important in trying to shut down isolated plants. Please give length of heating season, kind of building, pounds of fuel per cubic foot of building for heating season, price of fuel per ton of 2240 pounds, kind of heating system used and pressure required.

21—29. What central stations rent vacuum cleaners to their customers? What rental is charged?

22—37. What member companies give off-peak rates? How are these rates controlled and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

23—34. Will member companies give the cost per kilowatt or per horsepower of their different apparatus:

Boilers, including ash hoppers and grate bars.

Turbines, including generators and condensers.

Station piping, including all steam, feed, exhaust, and blow-off piping in the station.

Electrical apparatus, including high-tension and low-tension switches, high-tension control board, etc.

24—43. Where companies regularly inspect signs and outline lighting, what is the cost per lamp per year for this inspection and renewal labor? Do you consider the cost is covered by increased consumption of current? Would you advise such inspection in case of flate-rate outline and sign work, where competitive electric lighting companies are in the same field?

24—55. Do any of our member companies maintain a separate department or employment bureau for the purpose of receiving applications and keeping up a live eligible list of applicants for all classes of work in the service?

24—56. How many of our member companies keep a complete card index record of all past and present employes which may be referred to in answer to questions regarding past and present employes' ages, nationality, education, previous experience, salary, grade, and general record while employed by the company?

24—57. What experience have member companies had in keeping a partial or complete photographic record of all employes?

24—58. Do member companies compel applicants for positions in the electrical departments to undergo a physical examination, and if so does the applicant or the company bear the expense of same?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

National Electric Light Association

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June 24, 1911

CONTENTS

THE 1911 CONVENTION

The Association made a notable start upon its second quarter of a century with the thirty-fourth convention in New York City, May 29-June 2. The meeting would be memorable if only for the large attendance. The registration reached 5438, and while all these were not present, the places of the absent were filled by many hundreds who did not register. As the previous meeting in St. Louis had an attendance of 2700, it was thought that probably this year might see about 4000, and, in general, plans were made in adjustment to that estimate, but with a liberal margin of safety. As will be noted, the safety factor was none too large, but it is obvious that there are possibilities of great waste in providing excess accommodations. Fortunately, at no single meeting, event or function were the arrangements inadequate, and, on the whole, from this standpoint the convention was undoubtedly a great success.

Even mere numbers mean something when a progressive industry holds its annual parliament, but one must look further, to the work done. This again was most gratifying.

The seventy papers and reports were of high average, and the programme printed in these pages last month was carried out with even one or two additions. Some of the reports are invaluable, notably those on Line Construction and Preservation. The Public Policy report is in itself a landmark. The papers and discussions in the Accounting Section were wonderfully good, and while one or two of the reports in the Commercial Section were hardly up to the opportunity, on the whole the series was a most encouraging demonstration of what that branch of the Association can do in eliciting and presenting data.

One of the haunting fears in coming to New York for a convention is that the members will be drawn away from the meetings by other attractions. That ghost was certainly laid this time forever. More than once, during the convention, when three parallel sessions were going on simultaneously, nearly 2000 men were in attendance in the three halls, listening eagerly and debating warmly, and it was most inspiriting to wander from room to room and note the earnestness with which the problems of the hour were being attacked and the questions discussed. Such a body can go anywhere without the slightest fear that the real work of the convention will be neglected. The point comes up, as raised by President Freeman, as to how large such meetings can become with profit, and whether greater benefit does not lie in larger sectional and geographical work. The point is pertinent, but after the stimulus of that fine gathering held in New York City a couple of weeks ago, there will be a great many who would be loath to see any change which would lessen the opportunity for such a remarkable interchange of experience, knowledge and opinion, such a unique occasion for getting together and getting in touch with the whole field.

And there was entertainment, too, of a strenuous character, but none of it interfering with the regular work in the slightest degree. This planning was judicious, and when the week was over it left the sense more of completeness than of satiety, for while no hour had been crowded none had been left idle. The weather proved favorable, except for the baseball game, and even that little episode showed how readily the men turned to work, for one of the sections seized the chance at once for an extra and well-attended session. The meeting of 1911 has certainly secured its own bright and particular page of happy memories in the history of the Association.

THE NEW ADMINISTRATION

The growth witnessed during the administrations of Presidents Eglin, Frueauff and Freeman has been so great as to attract universal attention, bringing the Association up from 3000 members to 9000 in about two years. Forecasts are now made of 25,000 and 40,000 members, the total to be attained during the earlier part of the century, if the present ideas as to the full organization of the

industry are carried out along the lines now approved. Even a membership around 10,000 has its problems for an administration to work out, and it is fortunate that the Association enjoys in its leadership the succession of young men, of whom Mr. Gilchrist is the latest example. The succession is well provided for, as will be seen in running the eye over the list of the new administration; but the Association will need constantly more men of this type.

The work of the new year opens up at once in many directions. The Company Section plan awaits development, while the Geographic Section plan must be steadily pushed to its conclusion. The new Commercial and Power Transmission Sections, growing apace, have not yet quite "found themselves," and scarcely dream of the possibilities of usefulness before them. The decision to hold the next convention on the Pacific Coast, at once wise and progressive, carries with it many new considerations as to how the occasion shall be utilized to the greatest advantage both for the Association at large and for the local membership of the region visited.

In the administrative way the new year has several new problems of its own, additional to the above. It is not intended to allow the significant report of the Public Policy Committee to remain a dead letter; but to develop safely and sanely what one may call its selfish but disinterested humanitarianism will require no little study and effort applied to the whole industry. In like manner the relations with Public Service Commissions call all the time for closer harmonization, as, for example, in the adoption of the Standard Classification of Accounts. It is also seen that the Municipal Ownership movement, taking on new and perhaps more hopeful phases, requires a continuance of close observation and detailed investigation. The various proposals to make the Association more and more a clearing house for data, financial and otherwise, need to be dealt with carefully, and from different angles of view, if effective work is to be done. There is also to be carried out the excellent work begun last year in the scientific study of methods of resuscitation. These matters alone, if none other cropped up, would suffice to keep the incoming administration fairly well occupied throughout the year. But the task can be assumed cheerfully, with the knowledge that the renewed appeal to the devotion of the committees and the loyalty of the whole membership will as ever be responded to with enthusiasm.

Association Section Badges

Section badges in the Association are getting to be quite an institution. Brooklyn, Philadelphia, Chicago, New York and the Eastern New York division are all proud of their distinctive badges, and now comes the Toronto section with the first Canadian badge of the kind. Very appropriately it bears the maple leaf in the centre of its field.

CONSTITUTIONAL AMENDMENTS ADOPTED

At the executive meeting of the convention on May 31, Past-President Frueauff, as chairman of the Committee on Organization, introduced a number of proposed amendments to the constitution. These were taken up at the final meeting on June 2 and adopted unanimously. They are given below with the reasons assigned by Chairman Frueauff for their recommendation:

Article 3, Section 6, Page 11.—Amend by inserting after the word "connected," on line 3, the following:

"Or they may be other persons interested in advancing the central-station industry, not employed by a company eligible for membership, proposed and recommended by the Class A member in the territory where the applicant resides. They shall have the same privileges as Class D members."

The purpose of this amendment is to enable Company Sections, Geographic Sections or National Special Sections to have affiliated with them individuals who are closely allied with the section and yet hardly come within the scope of the Class D member class. Numerous requests for such an amendment have been made where companies and sections have been anxious to have individuals meet with them and aid in the building up of their organizations.

Article 4, Section 3, Page 13.—Amend to read:

"The Executive Committee shall consist of the president and vice-presidents, of the retiring president and of nine (9) members elected from Class A or Class B. Three (3) of the elective members shall be chosen at the annual convention, and they shall hold office for three (3) years from July 1, or until their successors are elected. Each of the above officers shall have one vote in meetings of the executive committee. The presidents of Geographic Sections and chairmen of National Special Sections shall be entitled to attend all meetings of the Executive Committee. The Geographic Sections, through their presidents in attendance, shall be entitled to two votes and the National Special Sections, through their chairmen in attendance, shall be entitled to one vote upon all matters acted upon at meetings of the Executive Committee. The presidents of Geographic Sections in attendance at any meeting of the Executive Committee shall divide equally the two votes to which their sections are entitled. The chairmen of National Special Sections shall divide equally the vote of their section. The president of the Association shall act as chairman of the committee."

The purpose of this amendment is to permit the Geographic and National Special Sections to have their presidents or chairmen attend all meetings of the Executive Committee and to be entitled to vote at the meetings of the committee. The limit, however, of two votes for Geographic Sections and one vote for National Special Sections is made so that the voting strength of the committee shall never be taken away from the duly elected representatives of the Class A members.

Article 7, Section 1, Page 16, lines 4 and 5.—Amend by striking out the words "receipts from electric sales" and insert in place thereof the words "earnings from sales of electric current."

The purpose of this change is to clear up a misunderstanding as to the intention in determining the amount of earnings upon which the member companies in cities of over 25,000 shall pay their dues.

Article 7, Section 2, Page 17.—Amend to read:

"The annual dues of Class B members shall be $5, including membership in a Geographic Section, and $2.50 additional for membership in each Special Section other than a Company Section."

The intention here is to provide definitely that the receipts from Class B members shall include the cost of belonging to the Geographic Section with which the member affiliates and that $2.50 additional shall be collected to maintain each National Special Section to which the Class B member belongs.

Article 7, Section 5, Page 18.—Amend to read:

"The annual dues of Class E members shall be $5, including membership in a Geographic Section, and $2.50 additional for membership in each Special Section other than a Company Section."

The intention here is to provide definitely that the receipts from Class E members shall include the cost of belonging to the Geographic Section with which the member affiliates, and that $2.50 additional shall be collected to maintain each National Special Section to which the Class E member belongs.

Article 7, Section 6, Page 18.—Amend by striking out the second sentence and inserting in place thereof the following:

"Any member in arrears for sixty days shall be suspended from all privileges of membership, but may be reinstated when he has paid all outstanding dues. In the event an applicant for Class B or Class E membership shall be elected after July 1 the dues for the remainder of the year shall be $3, which will entitle the member to a copy of the *Proceedings* and to the BULLETIN for the remainder of the year."

The purpose of this change is to shorten the time during which members enrolled shall receive the privileges of membership before being suspended for non-payment of dues, this being necessary to avoid the expense of compiling the *Proceedings* for members who fail to pay up promptly. It is also intended by this amendment to permit applicants to join in the latter half of the year by paying a fee of $3 for the remainder of the period. It has been found in many cases that prospective members withhold their applications until the first of the following year, not wanting to pay a full year's dues for a fractional year's benefits.

Article 13, Section 1, Page 22.—Amend to read:

"Upon application of five Class A members or two-thirds of all the Class A members if less than eight in any state, territory or dependency of the United States, Dominion of Canada or any other country in North America, the Executive Committee shall authorize the applicants to organize a Geographic Section of the National Electric Light Association to which all members of the National Electric Light Association in such Geographic Section shall be eligible for membership. Geographic Sections other than those herein stated may be formed subject to the approval of the Executive Committee."

The purpose of this change is at this time to permit the affiliation of the Canadian Electrical Association, which embraces membership from cities in the various provinces of Canada, and also to permit the merging in the future of other electrical associations that may be located in other sections of North America.

The last sentence of the present Article 13 is omitted so as to permit the formation of Geographic Sections

wherever desirable, subject to the approval of the Executive Committee.

Article 16, Section 1, Page 25.—Amend to read:

"Upon certification to the treasurer of the National Electric Light Association by the executive officers of any Geographic Section, stating the membership of such section who have paid dues for the full calendar year, and upon approval of the Executive Committee, the treasurer of the National Electric Light Association shall pay over to the proper officers of the said section an amount not to exceed one-half of the fixed yearly dues received from said members of the section, providing the Executive Committee may limit these appropriations to the legitimate expenses of the section. The term 'fixed dues' to designate that portion of the income received exclusive of the receipts from Class A members based on their gross income or from Class D members based on their enrolment at the convention."

"Section 2.—Upon certification to the treasurer of the National Electric Light Association by the executive officers of any National Special Section stating the paid-up membership of such section, and upon the approval of the Executive Committee, the treasurer of the National Electric Light Association shall pay over to the proper officers of said section an amount not to exceed $2.50 per year per member of said section, providing the Executive Committee may limit these appropriations to the legitimate expenses of the section."

The purpose of enlarging this article is to provide a method by which the amount due to the Geographic Sections and to the National Special Sections shall be paid over by the National Association.

It will be understood that these constitutional amendments having been adopted take effect from July 1.

The New Honorary Member

At the meeting of the Convention on the afternoon of June 1, President C. A. Coffin, of the General Electric Company, was unanimously elected an honorary member on the recommendation of the Executive Committee, he being the twenty-sixth in the twenty-sixth year of the Association. Mr. Coffin enjoyed a most enthusiastic reception, and responded to it and to the introduction of President Freeman with a brief but pithy address. He remarked that the electrical industry, considered in all its varied aspects, is one which should challenge the admiration and adherence, to the fullest extent, of those who are engaged in it. He expressed his admiration for and confidence in the Association and voiced a keen sense of the assistance which the body has rendered to himself and his associates. He emphasized the fact that electrical pursuits constitute possibly the most fascinating occupation in which a man can be engaged. One should experience a feeling of happiness and satisfaction in his own particular calling, he said; be proud of it and devoted to it. The electrical industry offers this feeling of satisfaction in a peculiar degree; there is nothing old or humdrum about it. Compared with what might be called the older industries, the career offered to a young man engaged in electrical pursuits is one which few would exchange for any other.

Mr. Edison was present on the platform during these exercises and, being himself an honorary member. witnessed with evident pleasure the conferring of the same honor upon his distinguished colleague in the field of electrical manufacturing. Mr. Edison remained throughout the afternoon and took great delight in a moving picture show accompanying a report by Mr. F. H. Gale.

PRESIDENT-ELECT GILCHRIST

Mr. John F. Gilchrist, the president-elect, whose duties in his new office will begin on July 1, is a native of Chicago, where he was born March 14, 1868. He was educated in the Chicago High Schools and in the law department of Lake Forest University, and in 1887 entered the employ of the Chicago Edison Company, which has had his services continuously ever since. His first position was virtually that of office boy, but he rose very rapidly, being assist-

JOHN F. GILCHRIST

ant to the manager of electrical sales from 1894 to 1896, and then contract agent. In 1906 he was made assistant to the president and still holds that position in the Commonwealth Edison Company. He is in addition second vice-president of the Illinois Valley Gas and Electric Company, treasurer of the Federal Sign Company and the Federal Sign System, and secretary of the Economy Light and Power Company of Joliet, Ill.

Mr. Gilchrist is an associate member of the American Institute of Electrical Engineers, and a member of the Illuminating Engineering Society, of which he has been a director. He is also a member of the Chicago Union League Club, Chicago Athletic Club, Chicago Yacht Club, Homewood Golf Club, South Shore Country Club of Chicago, the Engineers' Club of New York, and other kindred institutions. In the National Electric Light Association he has filled a number of positions, the last being that of first vice-president, while he was also chairman of the Committee on Rate Research, which presented an admirable report at the last convention. In 1906 he contributed a valuable paper to the Atlantic City convention on "Electric Signs," with forms of contract and city ordinance. In 1896 Mr. Gilchrist married Miss Emma Lock, and they have two children.

Election of Officers

At the final session of the convention on Friday afternoon, June 2, the Nominating Committee, comprising Messrs. J. W. Lieb, Jr., chairman; E. H. Davis, M. S. Hart, C. R. Huntley and R. F. Pack, presented its report embodying recommendations for officers as follows during the ensuing year:

President — John F. Gilchrist, Chicago.

First vice-president—Frank M. Tait, Dayton, Ohio.

Second vice-president—Arthur S. Huey, Oklahoma City, Okla.

Secretary—T. C. Martin, New York.

Treasurer—George H. Harries, Washington, D. C.

Members of the Executive Committee—W. W. Freeman, of Brooklyn; Charles L. Edgar, of Boston; Arthur Williams, of New York, and H. H. Scott, of Easton, Pa.

The report of the Nominating Committee was unanimously accepted, and the convention cast a unanimous ballot for the elective officers included in the report.

A Portrait of Miss Billings

One of the most interesting and pleasurable features of the convention was the presentation and acceptance of a fine oil portrait of Miss Harriet Billings, whose brilliant and devoted work for a score of years as assistant secretary of the Association, did so much to ensure its present success and usefulness. The portrait

trait was unveiled, and it h been hung in Miss Billing over her desk. Miss Billing her work with the Associa 1891. After the presenta message of greeting and con tion was sent to Miss Billing home in Arlington, Vt., in tl of the Association, by inst the committee being Messrs. W Eglin, Paul Doty and T. C.

MISS HARRIET BILLINGS

painted by Miss Jane Peterson, a friend of the subject, was given by Past-President Doherty, and the speech tendering it to the Association was made in most graceful and felicitous terms by Past-President Eglin, on behalf of the donor. At the moment of presentation, during the *opening session on* May 30, the por-

Award of the Doherty Medal

At the general session convention on Tuesday af May 31, when the subject c pany Sections was under dis the gold medal presented Henry L. Doherty for the be read before a Company Sect

awarded to Mr. Charles J. Russell, of the Philadelphia Electric Company. Mr. W. C. L. Eglin, of Philadelphia, made the report of the Committee of Award, which consisted of himself, Mr. Louis A. Ferguson, of Chicago; Mr. Sidney Hosmer, of Boston, and Mr. W. F. Wells, of Brooklyn. Twenty-nine papers were submitted to the committee, and all the jurors selected the same paper independently. The title of the paper is "Load-Factor Diversity and Power-Factor," and it was read by Mr. Russell before the Philadelphia Company Section in April, 1909. Mr. Russell was called to the platform and was handed the medal by President Freeman. In response, although unprepared, Mr. Russell made a felicitous speech in which he emphasized the vital importance of the rate question in view of the lack of standard practise in rate making. Mr. E. A. Baily, chairman of the Brooklyn Section, congratulated Mr. Russell on behalf of Brooklyn, and Mr. Arthur Williams, chairman of the New York Section, spoke in similar vein.

The medal is of gold and is two inches in diameter and about one-eighth inch thick. It weighs four ounces (avoirdupois). On the obverse it bears the inscription, "The Doherty Medal—National Electric Light Association," the words arranged in a circle. Within this circle is a design in relief symbolizing intellectual and industrial advancement by means of the applications of electricity. The reverse of the medal is adorned with a wreath and the badge of the National Electric Light Association, with space for the name of the recipient. It is understood that Mr. Doherty intends to make this an annual competition. If this is the case, the next contest is likely to develop keen interest and many competitors.

The Commercial Section Cup

The Commercial Section of the Association has grown wonderfully during the past year, one of the stimuli being a silver loving cup presented by Mr. J. Robert Crouse, Jr., to the member securing the largest number of new members. The cup was won by Mr. A. S. Huey, vice-president of H. M. Byllesby & Company, of Chicago, with 107 new members. At a dinner at the Hotel Martinique on June 1, at midnight, the cup was presented before a large gathering by President Freeman, and the temporary recipient was Mr. E. L. Callahan on behalf of Mr. Huey, who was kept away by illness. The chairman of the Section, Mr. George Williams, was present, and came near winning the cup himself. The dinner was a most enjoyable affair, and was accompanied by music and speeches.

Public Policy Committee Report on Welfare Work

A notably successful meeting of the Association was held at the New Theatre on the evening of May 31, when the report of the Public Policy Committee, embodying the series of recommendations covering several important features of welfare work, was read after its adoption at the morning executive session of the same day. Although it rained heavily, nearly 2000 persons were present, including many ladies. An elaborate musical programme was presented. The meeting was in charge of President Freeman, who spoke briefly; and the report was read by Past-President Insull, who followed it with pithy, appropriate comment.

An address, in hearty approval and sympathy with the plan unfolded, was then delivered by Secretary Charles Nagel, head of the U. S.

Department of Commerce and Labor, who said that no body in the country was better able than the Association to send such a current of enlightenment throughout the country and the world. His address was received with frequent and great applause.

Incidentally it may be noted that twice recently—in April and May—the Association has thus had at its meetings members of the Taft Cabinet—Mr. Fisher, Secretary of the Department of the Interior, having attended the Water Power Conference in April.

The Baseball Trophy

A handsome three-handled sterling silver loving cup, lined with gold and standing nearly 12 inches high, has been presented to the Association by the Westinghouse Electric and Manufacturing Company as a baseball trophy to be contested for by amateur teams, composed of members of the Association, during the annual conventions each year. The design is an original one by Tiffany & Company, New York, and was wrought in the silver shops of the company under the direction of Dr. George F. Kunz. Engraved on the exterior of the cup is the following inscription: "Westinghouse Cup, presented by the Westinghouse Electric and Manufacturing Company to the National Electric Light Association (here follows the N. E. L. A. symbol), to be competed for at annual conventions by baseball teams composed of members of the Association and to be held in trust at Association headquarters. MCMXI." The presentation of this beautiful trophy is appreciated greatly both by the Association and the baseball enthusiasts. It was intended to have the first contest for the cup on Wednesday afternoon, May 31, but very bad weather interfered with the programme. The competing teams of the Brooklyn Edison Company and Philadelphia Electric Company had therefore to postpone the game a week, when the match resulted in favor of Brooklyn with a score of 5 to 3. Each year the record will be engraved on the cup. In addition, this year the sub-committee on baseball presented each of the members of the winning team with a gold watch as a personal souvenir of the event.

CONTINUED GROWTH IN MEMBERSHIP

This month there is presented another long list of new members, bringing the total as of June 15 up to somewhat in excess of 8950. The list includes 16 Class A, 1031 Class B, 1 Class C, 9 Class D and 81 Class E, making a total of 1138. This is the last list of the current executive year, which began with a total of 5520 members, so that the net gain for the year is not less than 3430, and will probably exceed that figure before the month is out and the new administration comes into office. On June 15 the classification of the membership was as follows: 962 Class A, 6902 Class B, 19 Class C, 231 Class D, 837 Class E, making a total of 8951.

NEW MEMBERS

Class A: Oceanside Electric and Gas Company (San Diego Co.), Oceanside, Cal.; South San Francisco Power and Light Company (San Mateo Co.), South San Francisco, Cal.; Tifton Ice and Power Company, Tifton, Ga.; The LaHarpe Electric Light and Power Company, LaHarpe, Ill.; The Robinson Water, Light and Heat Company, Robinson, Ill.; Chester Electric Light Co., Chester, Mass.; Tarkio Electric and Water Company, Tarkio, Mo.; Hughes Electric Company, Glendive, Mont.; Federal Light and Traction Company, New York City; Union Gas and Electric Company, Cincinnati, Ohio; Hamilton Gas and Electric Company, Hamilton, Ohio; The Eureka Electric

Light, Heat and Power Company, Upper Darby P. O., Penn.; The Spartanburg Railway, Gas and Electric Company, Spartanburg, S. C.; J. F. Boyd, Shelbyville, Tenn.; Joseph R. Nutt, Fort Worth, Tex.; Washington-Oregon Corporation, Vancouver, Wash.; The Tomah Electric and Telephone Company, Tomah, Wis.

Class C: F. W. Schiller, Utica, N. Y.

Class D: Mills Electric Company, Peoria, Ill.

Robertson Engineering Company, Baltimore, Md.

The Lombard Governor Company, Ashland, Mass.

The Holtzer-Cabot Electric Company, Boston, Mass.

The Electric Heat Storage Company, New York City.

The A. and W. Electric Sign Company, Cleveland, Ohio.

The F. Bissell Company, Toledo, Ohio.

The American Ship Windlass Company, Providence, R. I.

Montague Mailing Machinery Company, Chattanooga, Tenn.

Class E: Pacific Electric Heating Company, Ontario, Cal.—Howard A. Lewis.

Bryan-Marsh Company, Chicago, Ill.—A. W. Marcon, J. A. Munroe.

The Brilliant Electric Company, Indianapolis, Ind.—F. H. Stapp.

New England Telephone and Telegraph Company, Boston, Mass.—Deane B. Small.

Anderson Electric Car Company, Detroit, Mich.—W. C. Anderson, George M. Bacon.

Vulcan Electric Heating Company, Buffalo, N. Y.—F. J. Holmes.

Electrical Testing Laboratories, New York City.—F. M. Farmer, Preston S. Millar.

Electrical World, New York City.—A. E. Clifford, James H. McGraw, H. T. Matthews.

General Electric Company, New York City.—John B. Barr, C. W. Bettcher, R. M. Birely, H. C. Hall, A. S. Moody, James J. Sullivan.

Western Electric Company, New York City.—H. R. King, W. L. Stockton.

J. G. White and Company, New York City.—H. S. Collette, H. J. Douds, S. D. Sprong.

Diamond Rubber Company, Akron, Ohio.—Howard R. Sharkey.

The A. and W. Electric Sign Company, Cleveland, Ohio.—W. M. Knapp, Jr.

National Electric Lamp Association, Cleveland, Ohio.—R. E. Scott, F. S. Terry, B. G. Tremaine, H. A. Tremaine, J. M. Woodward.

Fostoria Incandenscent Lamp Company, Fostoria, Ohio.—E. V. Plane, F. H. Singer.

Ohio Brass Company, Mansfield, Ohio.—N. M. Garland.

The Sterling Electrical Manufacturing Company, Warren, Ohio.—M. D. Phelps.

Banner Electric Company, Youngstown, Ohio.—D. B. Broad, I. E. Christman, J. E. Hart.

The Electric Storage Battery Company, Philadelphia, Penn.—H. B. Marshall.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Penn.—George H. Criss, C. E. Hardy, H. H. Hughes, George R. Sailor, J. M. Tomb, E. A. Thornwell.

Electric Supply Company, Memphis, Tenn.—W. R. Herstein.

Allis-Chalmers Company, Milwaukee, Wis.—J. T. Cunningham, F. W. Stevens.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.—A. W. Berresford, George B. Katzenstein.

Electrical Review Publishing Company, Chicago, Ill.—A. A. Gray.

Sangamo Electric Company, Chicago, Ill.—H. W. Young.

Minerallac Electric Company, Chicago, Ill.—Chester I. Hall.

H. B. Camp Company, New York City.—C. C. Baird.

The Central Station, New York City.—H. C. Cushing, Jr.

General Electric Company, New York City.—F. E. Getts, H. J. Mauger, Edward Minzesheimer, H. B. Rogers, R. S. Scott, W. W. Torrence.

C. W. Lee Company, New York City.—Robert N. Lee.

Western Electric Company, New York City.—G. Swope.

Adams Bagnall Electric Company, Cleveland, Ohio.—Charles L. Eshleman.

National Electric Lamp Association, Cleveland, Ohio.—R. E. Campbell, Ward Harrison, Winthrop Talbot.

Pittsburgh Transformer Company, Pittsburgh, Penn.—H. G. Steele.

Pittsburgh Reinforcing Pole Company, Pittsburgh, Penn.—W. A. McCombs.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Penn.—S. A. Chase, H. A. Coles, John K.

Coutant, John Z. Kelley, Charles M. Kirkpatrick, V. W. Shear.

Bryan-Marsh Company, Central Falls, R. I.—J. O. Ball, M. Clark, D. W. Eyman, J. K. Johnston, C. R. Tock, G. W. Wrght.

Canadian General Electric Company, Montreal, Que.—J. W. Pucher.

Anniston Electric and Gas Company, Anniston, Ala.—C. M. Maxwell.

Class B: Birmingham Railway, Light and Power Company, Birmingham, Ala.—Frank Hammond, Jr.

Montgomery Light and Water Power Company, Montgomery, Ala.—A. S. Lowrie, G. A. Ralston, W. E. Weare.

San Joaquin Light and Power Corporation, Fresno, Cal.—E. B. Walthall.

Southern California Edison Company, Los Angeles, Cal.—W. A. Brackenridge, A. W. McPherson, William E. Oliver, John Otto, W. T. Sterling, Byron T. Story, R. J. C. Wood.

Pacific Gas and Electric Company, San Francisco, Cal.—W. F. Blide, F. E. Cronise.

Denver Gas and Electric Company, Denver, Colo.—Ferdinand Hauff, A. T. Hutchins, William C. Mount.

Willimantic Gas and Electric Light Company, Willimantic, Conn.—David Loree.

Potomac Electric Power Company, Washington, D. C.—Proctor L. Dougherty, Clarence F. Norment.

Tampa Electric Company, Tampa, Fla.—George H. Wygant.

The Columbus Power Company, Columbus, Ga.—John S. Bleecker, George K. Hutchins.

H. M. Byllesby and Company, Chicago, Ill.—Elmer Dover, Robert J. Graf, R. G. Hunt, J. J. O'Brien, Otto E. Osthoff, R. E. Wilsey, N. P. Zech.

Commonwealth Edison Company, Chicago, Ill.—James C. Allstrom, George Wesley Anderson, C. F. Austin, O. Bachlin, James C. Baker, Walter F. Ballard, T. Ballinger, William Bartley, R. H. Bashelier, Theodore Becker, John Behan, John Bentley, R. H. Bettledorf, Paul P. Bird, J. S. Bisbee, Elmer L. Bisson, Raymond I. Boniface, Hugo Borgstrom, Benjamin Brackney, Lee R. Bradley, C. Brennan, H. B. Brown, B. D. Buell, George Burkhard, William Buttner, E. E. Campbell, C. J. Carlsen, T. R. Capouch, J. J. Carroll, James Casey, John F. Chase, John M. Clark, Frank Conklin, Harry Cotter, Sidney S. Crozier, Wilfred Davis, T. Dellacroce, George DeMars, H. DeSenville, Earl W. Dickerson, C. P. Dodge, John Downey, Carl H. Dunlap, R. R. Dwyer, W. A. Dwyer, R. J. Eagan, Oscar F. Eckstein, T. Eilenberger, Ole Ekeberg, W. A. Faughner, W. H. Flexner, Frank Foley, LeRoy Fox, Earl C. Frost, Mason A. Fullerton, Willard M. Galusha, M. J. Gavin, H. B. Goodwin, J. H. Gordon, Harry Green, P. C. Grey, William J. Hamilton, Edward Hansen, John Hansen, Oscar Hansen, W. L. Hanson, E. Harkie, Ernest Harmon, Michael Hayes, M. Healy, Paul A. Heise, George M. Helland, A. P. Hilberg, Thomas Hopcroft, James A. Horan, Joseph Hummel, W. P. Hynes, J. S. Jackson, John B. Jackson, Elmer C. James, Dow J. Jewell, Herbert B. Johnson, O. Johnson, P. Jorgenson, Charles Josef, H. G. Karmann, E. Karnsted, H. J. Kaufman, George J. Keckeisen, John C. Kelley, W. G. Kelley, George Kennedy, Peter J. Klinker, Fred. W. Knoff, George Koblenz, W. J. Koehler, Emory Korth, John Kraus, S. Lake, Clarence M. Lambie, Frank A. Lang, John Lauer, M. Leggate, David Levin, Charles Benjamin Lewman, R. B. Lloyd, John Lucas, Harold J. McClelland, E. McDonald, Hugh MacDonald, D. McDowell, E. D. MacEwing, James F. McFarland, John J. McHale, J. H. McKenna, M. H. McMillan, Raymond A. Mahn, F. J. Mann, D. E. Mason, H. C. Masterson, S. Maynard, Charles Medal, B. A. Mehan, H. E. Meierhoff, J. H. Meurer, Alfred Miller, William Miller, Harry C. Mosher, Clete C. Mull, G. C. Murfey, William S. Murphy, Charles J. Murrin, Henry C. Nagel, Emil Nelson, James Newmier, S. H. North, Frank O'Brien, E. M. O'Connor, L. J. Olsen, P. H. O'Neill, John J. Owens, Joseph Pabst, Harvey S. Pardee, J. W. Parker, W W. Parker, Theodore E. Peterson, Edwin W. Puffer, W. G. Putnam, A. H. Quest, W. A. Rak, Ben. Rehling, M. L. Reiner, John J. Rhode, Karl L. Rick, Louis J. Riedle, Arthur C. Robbins, P. J. Romberg, E. J. Rottman, M. J Russell, Joseph Sabbia, E. Sandberg, J. Howard Sandidge, William A. Sanford, William Scheuneman, W. H Schrouder, T. Shanahan, Edward B. Sherman, A. W. Sims, H. Smales, B J. Smith, Fred Smith, H. Wylie Smith, W. J. Smith, Walter H. Smith, William A. Sommer, G. F. Spaulding, Walter Stanton, Jacob E. Stein, Frank Stevens, Fred. J. Story, E. R. Streight, R. J. Stretch, R. E. Sweetland, R. A Taylor, Howard S. Thomas, L. E. Tidsick, Wallace R. Tiffany, Herman L.

Turner, C. C. Underwood, Charles Urban, J. M. van Delden, A. Van Zeverey, Charles William Walker, J. W. Walker, Robert Wallace, J. M. Weber, R. H. Whitehead, Charles E. Whittingnam, T. P. Willerton, J. B. Williams, John Wilson, John Wissman, William H. Woertz, Harry J. Worcester, Robert C. Wordel.

North Shore Electric Company, Chicago, Ill.—Theodore Blech, J. E. Harlow, A. V. Horn, Fred O. Grey, E. C. Minteer, J. P. Pierce.

Interstate Light and Power Company, Galena, Ill.—W. B. Ross.

Economy Light and Power Company, Joliet, Ill.—Bruce Ridenour, Arthur Sandiford, John R. Staley, Elmer E. Themes.

Central Illinois Public Service Company, Matoon, Ill.—C. W. Barlow, Charles C. Hartley, Frank J. Millar.

Illinois Valley Gas and Electric Company, Streator, Ill.—I. R. Laub, M. G. Neff, Theodore H. Munroe, M. D. Parks, Charles W. Seibel, J. M. Strasser.

Gary Heat, Light and Water Company, Gary, Ind.—George M. Dunkle.

Northern Indiana Gas and Electric Company, Hammond, Ind.—William D. Ray.

Marion Light and Heating Company, Marion, Ind.—Homer E. Gant.

Union Electric Company, Dubuque, Iowa.—L. D. Mathes.

Oskaloosa Traction and Light Company, Oskaloosa, Iowa.—H. W. Garner.

Ottumwa Railway and Light Company, Ottumwa, Iowa.—Thomas R. Combiths.

Kentucky Electric Company, Louisville, Ky.—R. E. Hughes.

Shreveport Gas and Electric Company, Shreveport, La.—J. E. Cowles.

Frederick Gas and Electric Company, Frederick, Md.—J. H. Enright.

Boston Electric Illuminating Company, Boston, Mass.—Daniel James Carmichael, A. H. Heininger, George H. MacGilvray, John W. Murray, J. W. O'Neil, Russell S. Pond, James A. Walton.

Stone and Webster Management Association, Boston, Mass.—Robert Hamilton.

Brockton Edison Electric Illuminating Company, Brockton, Mass.—D. M. DeBard, F. A. Rogers, Walter G. Ross, H. C. Smith.

Lowell Electric Light Company, Lowell, Mass.—Royal Parkinson, A. Stuart Pratt.

Plymouth Electric Light Company, Plymouth, Mass.—E. P. Rowell.

Houghton County Electric Light Company, Houghton, Mich.—Gardner Rogers.

Duluth Edison Electric Company, Duluth, Minn.—C. E. Van Bergen.

Consumers Power Company, Faribault, Minn.—S. H. Harrison, E. B. Korst, Alfred May, A. E. Stevens.

The Minneapolis General Electric Company, Minneapolis, Minn.—Joseph Husband.

Meridian Light and Railway Company, Meridian, Miss.—L. G. Dickson, I. W. McArthur, C. L. McBride.

The Empire District Electric Company, Joplin, Mo.—I. O. Allen, Frank Hartin, W. Hartman, H. M. Lewis, A. F. Minnish, C. T. Winter.

Kansas City Electric Light Company, Kansas City, Mo.—Charles A. Stanley.

Suburban Electric Light and Power Company, St. Louis, Mo.—A. C. Einstein.

Union Electric Light and Power Company, St. Louis, Mo.—E. Chalmers Bennett, John Hunkeler, Howard F. Neale, H. H. Reed, George L. Reno, W. H. Schall, H. N. Thomas.

Public Service Electric Company, Newark, N. J.—William S. Davis, William Muir Halsey, Charles Kugler, George E. Reed, Addison E. Schoonover, C. Harold Tilton, Ralph I. Wilson.

Auburn Light, Heat and Power Company, Auburn, N. Y.—Henry L. Coleman, H. L. Montgomery.

Genesee Light and Power Company, Batavia, N. Y.—H. K. Stein.

The Flatbush Gas Company, Brooklyn, N. Y.—W. J. Carberry, Edwin C. Hollis, William F. Lennon, Charles G. Seeba, George O. Young.

Edison Electric Illuminating Company, Brooklyn, N. Y.—Joseph G. Bogeart, Stephen Brett, Charles P. Canavello, Anders Peter Carlsen, E. C. Corrigan, Charles H. Cottrell, John A. Croghan, Sidney W. Diossy, Clarence G. Foggan, Richard V. Hollahan, Charles L. Keegan, Robert J. Kennedy, Frank K. King, Ferdinand F. Klenk, Joseph Leary, John E. McVey, A. L. Moran, George J. Moriarty, Simon Pasqualin, William J. Pich, Edward A. Porr, Ernest P. Rylander, P. M. Safford, John W. Sehy, Rogers Van Wyck Sammis.

Niagara and Erie Power Company, Buffalo, N. Y.—Harry B. Zimmerman.

Queens Borough Gas and Electric Company, Far Rockaway, N. Y.—Edward A. Alexander, Charles F. Anderson, Frank G. Barrie, Lloyd L. Craft, Eugene Demme, Charles Eckhardt, Bernard Fallon, Jr.; James Fox, John M. Holmes, H. H. Hogan, R. V. Howes, Abraham Kleinman, Harold Stott, Harry J. Vaughn.

New York and Queens Electric Light and Power Company, Long Island City, N. Y.—C. C. Arnold, E. Boose, Maude M. Brawley, R. Brien, Melvin Brown, Owen Clasby, T. Clasby, James Cosgrove, Emma E. Day, Arthur Henry Dobbins, William Dobbins, Charles F. Fey, P. J. Fushi, Henry J. Goetle, Julius Hauck, John F. Kessler, James Kiley, R. Latham, James Leonard, Thomas McDonald, Hugh A. McGovern, Frank J. McGowan, Joseph Mahony, Madeline M. Palm, J. Wadsworth Patton, A. Prodant, Maude Ritterhoff, Leroy Sammis, H. B. Samuels-Pos, Ellen A. Schwarz, Charles Sutherland.

Westchester Lighting Company, Mt. Vernon, N. Y.—Lee Alger, Albert E. Arnold, George Banks, W. Beel, S. S. Coles, C. DeLade, B. F. Engel, Ralph C. Gerlach, Sidney Holt, R. J. Joyce, H. W. Kemp, Robert Madden, Leo A. Mangan, William J. Mangan, J. S. Messler, George S. Miller, W. Minnerly, A. J. Meyer, Henry C. Muller, Charles Otten, Jr., Clayton S. Parker, R. G. Pultz, Michael Salotto, Arthur G. Shaffer, J. C. McAuley Shrewsbury, John F. Stewart, Frederick A. Sudmal, W. F. Taber.

Richmond Light and Railroad Company, New Brighton, N. Y.—E. O. Collier, William Dunn, Fred Hommel, G. Scheulen.

Muskogee Gas and Electric Company, Muskogee, Okla.—F. A. Strassweg.

Oklahoma Gas and Electric Company, Oklahoma City, Okla.—B. W. Brunnell, Howard Huey.

Pacific Power and Light Company, Portland, Ore.—James E. Davidson, A. M. Locke, Local Manager, Dayton Plant; Local Manager, Goldendale Plant; Local Manager, Pomroy Plant; Local Manager, Waitsburg Plant; Local Manager, White Salmon; H. S. Wells, W. M. Wood, N. L. Young.

Penn Central Light and Power Company, Altoona, Pa.—B. F. Cleaves, D. F. Frodette, M. A. Miller, J. E. Shute, J. A. Walker, Hal Woolson.

The West Penn. Electric Company, —William Rogers.

Easton Gas and Electric Company, Easton, Pa.—E. J. Reilly.

The Philadelphia Electric Company, Philadelphia, Penn.—B. H. Baker, Sanford Bilyeu, H. Black, B. B. Bouchelle, A. A. Boyle, George W. Brauckmann, Joseph Brewster, William H. Brown, Freeman G. Butz, William L. Buzby, Joseph Cassidy, E. C. Crowe, E. N. Dickie, Joseph A. Donnelly, Abram P. Eaton, Daniel A. Fitzgerald, Jr.; Ormond F. Fitzgerald, J. Morton Fultz, Frank J. Furman, Joseph Gallagher, John H. Gelphe, Charles F. Geyer, Alexander B. Gilfillan, W. B. Gordon, William C. Grace, Lawrence Guest, William Frederick Hahn, William F. Hakspacher, Jr.; A. C. Hart, John Hedricks, William K. Holmes, William L. Hoos, Jr.; Robert E. John, William E. Johnston, Joseph H. Kennedy, Orville Kerbaugh, Burl E. Kirk, Max Lowenthal, William J. Lynch, Charles A. MacDonald, I. D. McHenry, R. A. Mawson, William J. Menah, H. Paul Miller, Frank Moore, C. E. Morgan, 3rd; Charles M. Neal, Frank K. Obertholtzer, G. A. Penrose, William Park Quig, Thomas Rawlings, Jr.; Herbert S. Redmond, John F. Reinhard, George Reynolds, Oscar Robinson, Elmer Royle, Frank R. Ruggles, Carl Shinn, George H. Simon, B. B. Smith, R. Stuart Smith, Thomas Smith, W. H. Terry, Thomas Tacey, Jr.; George B. Thomas, George A. Timlin, Jr.; Joseph R. Tittermary, George H. Trenwith, Frank J. Tyson, F. H. Wallace, William T. Watson, Alexander Wilson, 3rd; Charles O. Wisler, Charles Woelfle, Thomas B. Wright, Walter E. Wright, William Zeiss.

American Gas and Electric Company, New York City.—Adam Gschwindt, George W. Thomson, Leon Tidd.

Cities Service Company, New York City.—W. B. S. Winans.

Electric Bond and Share Company, New York City.—M. H. Arning, E. W. Hill, E. P. Summerson.

Federal Light and Traction Company, New York City.—C. C. Chappelle, W. W. Ferris.

New York Edison Company, New York City.—B. Abbott, Charles Anderson, E. P. Apgar, Joseph F. Armour, Harry P. Armstrong, Fred. Aschenbach, Ellis H. Bacon, Paul H. Bacon, Justis V. Baum, William F. Benning-

ton, Aram Berberian, H. Berger, Stephen Beunis, F. Black, John E. Blandford, William Blauvelt, Robert Blue, A. Boeseh, Felix A. Bonomi, P. M. Bonton, J. C. Borger, H. G. Boyd, James J. Brennan, James Brierty, Jr., M. Ten Broeke, DeWitt Brown, Thomas J. Brown, William H. Browne, Harry Bruckler, William Buchsbaum, R. R. Buckley, Horatio J. Bullions, Joseph L. Burbige, W. J. Burke, Joseph J. Burnes, Alexander Burri, Whitney A. Campbell, Thomas W. Cann, Lee C. Carlton, Thomas J. Carroll, George W. Christians, J. W. Clark, P. L. Clark, H. W. Classen, James E. Collie, Frank Coney, P. D. Conine, Millard S. Conlon, Ainslie Connolly, E. H. Crawford, James S. Curtayne, Paul A. Curtis, Jr., Bernard Daly, Richard Darlington, John Davies, James A. Davis, James M. Davis, Harry Daw, Christopher C. Day, A. J. DeLisio, William H. J. Dempsey, George Denninger, H. T. de Rivera, Alexander H. Dibelius, Rudolf Diesel, Jr., Alfred Divine, R. C. Dohlberg, Charles F. Dohrenwend, Frederick J. Dreyfuss, Cornelius E. Driscoll, Max Drucker, Jr., John Drugan, J. T. Dugan, John Duncan, George E. Eagle, Gordon Eastlake, Nile R. Ellis, W. B. Ellis, Troy W. Ellerbrook, John N. Eisenbast, Martin L. Evans, William M. Farmer, George B. Faucett, Edward G. Feist, Isaac Files, Henry C. Fling, Thomas H. Flowers, Richard X. Flynn, Stephen J. Flynn, Gus. Gering, Charles Glueck, Jr., E. Goodhue, William F. Gordon, George C. Gossman, M. J. Grace, Charles B. Brady, Edwin G. Grandstaff, William L. Greenfield, J. E. Greenwald, Alexander F. Haff, J. Hagan, H. Haggerty, Herbert S. Hall, Hugh J. Hall, Gustave Harz, F. H. Hay, Edward Hayden, Harry Heller, William J. Hennessy, W. H. Hill, A. C. Hillman, J. M. Hoagland, William G. Hoffman, Joseph Hoffmann, G. W. Hogan, Reinhardt Hoyer, W. F. Holler, William N. Hoyle, Alfred M. James, John P. Jardin, Alexander V. Jensen, O. B. Jensen, W. T. Johnson, William F. Jones, Willis E. Jones, Thomas A. Joyce, Arthur J. Kane, Timothy Keegan, Thomas Keenan, J. Keller, Frank J. Kelly, Frank J. Kemly, Joseph J. Kennedy C. G. Kilbourne, Arthur S. Kimmens, C. A. Kingsbury, G. C. Kinnaird, Antoinette J. Kronin, Louis Kuhn, Charles I. Kunsman, Charles J. Kunsman, Jr., W. R. Lafferty, Alvin P. Laughlin, William F. Laux, Jeremiah F. Lee, H. H. Lehmann, N. W. Leidy, Douglas B. Leigh, Frank C. Lingren, Frank Long, Eric C. Loth, Joseph S. Lutz, Joseph A. Lyons, Gilbert McClellan, James J. McCluskey, Joseph McCourt, John L. McDermott, J. D. McDonald, Thomas J. McDowell, Frank J. McGinniss, Thomas F. McGowan, Thomas McInerney, Frank McShane, F. J. McMahon, Owen McNamara, John A. MacVeagh, S. T. Mahony, A. J. Mariotti, Charles A. Mason, C. C. Mattern, C. C. Matthews, Charles William Matthews, Norman Maul, Joseph F. Meehan, George Merganthaler, F. F. Merrense, J. Merrihew, Harry Milbouer, W. L. Miller, Ira Canfield Mitchell, H. W. Mix, Robert Mockel, F. F. Mollmann, Thomas O. Morgan, Harry E. Mortimer, Grover Mueller, W. Muhlker, T. S. Mullane, Louis F. Muller, Michael J. Murphy, Richard L. Murphy, D. B. Murray, J. B. Murray, A. C. Nissen, H. D. Nathan, H. I. Northshield, Frank H. Nugent, J. C. O'Connor, Denis J. O'Donnell, William Oechler, Andrew J. O'Hara, John O'Leary, John O'Mahony, Howard H. O'Neal, Walter Lee Osborne, Martin Ostrich, Emil Otto, James W. Owens, J. E. Parker, Francis J. Phelan, William P. Phelan, M. L. Pomares, Harry A. Pont, Edwin H. Pratt, Stephen Price, J. Quigley, M. J. Quigley, A. R. Rabe, Fred Rahn, Angelo Raicco, Henry S. Reilly, S. G. Reque, August Retzlaff, John L'E. Reynolds, John Riley, E. Ringheim, John F. Rodgers, William Rodgers, R. D. Rollisson, W. P. Roos, A. Charles Russell, Walter C. Ryan, Fred. Sandbeck, R. S. Sayer, Jr., F. L. Schildknecht, Frank Schmitt, August Schneider, L. C. Schoeller, Archibald Scott, H. R. Searing, John C. Selby, Fred. D. Shadell, Thomas A. Sheehan, William Smart, Harrison J. Smith, Sanford Smith, Alden H. Sprague, F. P. Starr, George B. Stevenson, Frank J. Stock, Jr., E. D. Stockwell, Fred. A. Stude, Herman Sussman, Judson B. Sutfin, Harvey Swartout, James A. Taylor, William D. Taylor, A. E. Tibbo, John Joseph Tobin, William Tobin, Philip Torchio, Samuel Townsend, Warren L. Trueman, H. K. Turner, Edward Ubriac, H. E. Ursprung, John R. Vail, W. F. Vail, Ernest Van Duyne, John W. Van Wert, H. G. Van Wettering, Harry C. Vaughan, James Velten, William A. Vint, J. Vogel, August Vorwald, Edward J. Walsh, William J. Walsh, Milford S. Ward, W. E. Watkins, Felix Weill, Clement J. Weixel,

George Welch, Jr., Rudolph Welk, Walter A. Wemyss, Jr., Alvin S. Westcott, Frank T. Wetter, E. V. Whigam, John G. Whitaker, L. J. Wiencke, Andrew F. Williams, Fred. A. Williams, Francis B. Wills, Charles C. Worth, H. C. Yost, Charles Zeiss, Rudolf K. Zoellner, Paul M. Zuaro.

The United Electric Light and Power Company, New York City.—Reginald W. Barrows, H. C. Boschen, John A. Burke, H. E. Cole, Matthew B. Daly, H. Devlin, James F. Devlin, Charles O. Diedrickson, Thomas Fitzpatrick, John J. Forshay, Vincent Franchini, Walter H. Funke, William H. Hindhaugh, Victor H. Martin, B. Nielsen, T. Nielsen, H. N. Plante, Leonard H. Quinlan, August H. Randel, John E. Scanlan, Frank W. Stoddard, Joseph L. Taylor, Charles William Wagner, Albert E. Wyatt, F. R. Zabel.

Buffalo and Niagara Falls Electric Light and Power Company, Niagara Falls, N. Y.—George J. Reichert.

Tonawanda Power Company, North Tonawanda, N. Y.—Francis M. Gordon.

Northern Westchester Lighting Company, Ossining, N. Y.—James T. Kay.

Peekskill Lighting and Railroad Company, Peekskill, N. Y.—H. W. Aisthorpe, Elbert H. Bagley, John S. Curry, Robert Stevenson.

Schenectady Illuminating Company, Schenectady, N. Y.—Willard L. Carr.

Syracuse Lighting Company, Syracuse, N. Y.—Ernest Johnston, Robert H. Knowlton.

Bronx Gas and Electric Company, Westchester, N. Y.—Charles D. Bible, William Bible, J. Morris Butler, D. H. Coddington, Clarence J. Ferdon, Charles Klein, Edwin E. Leffler, John J. Schneider, William E. Towner, Harry Von Dwingelo, William Von Dwingelo, John Walpole, Harry A. Weber.

Yonkers Electric Light and Power Company, Yonkers, N. Y.—L. D. Briant.

Durham Traction Company, Durham, N. C.—R. L. Lindsey.

Union Gas and Electric Company, Cincinnati, Ohio.—J. D. Lyon.

Middleton Gas and Electric Company, Middleton, Ohio.—G. N. Clapp.

The Xenia Gas and Electric Company, Xenia, Ohio.—F. C. Barr, W. B. Hill.

Mahoning and Shenango Railway and Light Company, Youngstown, Ohio.—E. H. Bell.

United Gas Improvement Company, Philadelphia, Penn.—William C. Janney.

Allegheny County Light Company, Pittsburgh, Penn.—George W. Dewey, Edward C. Dietz, C. A. Feathers, Erwin Henderson, W. R. Hodel, A. Ilginfritz, Joseph P. McAteer, T. C. O'Sullivan, W. E. Pepper, Harvey Reno, A. F. Strouse, H. E. White.

Pittsburgh Reinforcing Pole Company, Pittsburgh, Penn.—W. A. McCombs.

Metropolitan Electric Company, Reading, Penn.—Walter J. Jones, Charles H. Lindsay.

Scranton Electric Company, Scranton, Penn.—G. W. Colton, George W. Dewey, Victor E. Northup, John F. Reilly, Clarence E. Williams.

Home Electric Light and Steam Heating Company, Tyrone, Penn.—T. J. McKinley.

Warren Electric Light Company, Warren, Penn.—N. H. Spencer.

Woonsocket Electric Machine and Power Company, Woonsocket, Rhode Island.—Ralph O. Ditson.

Consolidated Power and Light Company, Deadwood, South Dak.—Morgan M. Maghee.

Bristol Gas and Electric Company, Bristol, Tenn.— C. W. Fergueson, W. A. Williamson.

Knoxville Railway and Light Company, Knoxville, Tenn.—J. H. Drake.

Merchants Power Company, Memphis, Tenn.—J. J. Brennan, V. A. Henderson, L. G. Van Ness.

San Antonio Gas and Electric Company, San Antonio, Texas.—Ward S. Albro, Carl Anderson, V. H. Braunig, W. F. Caldwell, Louis N. Edwards, J. B. Franzini, C. H. Froebel, R. L. Goldthorp, M. L. Hibbard, R. Huffaker, M. Kimbro, R. B. Langston.

Manchester Light and Power Company, Manchester, Vermont.—A. B. Marsden.

Whatcom County Railway and Light Company, Bellingham, Wash.—Leslie R. Coffin.

Olympia Light and Power Company, Olympia, Wash.—Phil. Skillman, Jr.

Seattle Electric Company, Seattle, Wash.—H. M. Winter.

Reservation Electric Company, Toppenish, Wash.—Local Manager.

Washington-Oregon Corporation, Vancouver, Wash.—Wilbur B. Foshay.

Kenosha Gas and Electric Company, Kenosha, Wis.—Roger U. Kimball.

Madison Gas and Electric Company, Madison, Wis.—E. H. Kifer.

Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—J. S. Bartels, A. L. Becker, Clarendon M. Berry, Fred V. Benz, Hans E. Birkholz, Frank J. Boehm, Alfred J. Bohl, I. W. Bolton, Conrad F. Boos, J. D. Bottenberg, J. B. Brauns, Charles A. Cahill, Harrison W. Chambers, W. C. Chapman, J. A. Chevnerton, O. H. Childs, C. Colin, John E. Cook, R. G. Cox, T. D. Crocker, Charles I. Danielson, Bert A. Dannenfelser, L. Dittmar, J. R. Dishington, Egbert Douglas, Julius F. Gamradt, A. J. Goedjen, Philip Grossman, William E. Gundlach, S. D. Hoyt, William S. Hill, Irving O. Hinickle, William J. Hommel, C. E. Horn, Elmer D. Johnston, Arthur C. Juul, Otto C. Kaestner, Paul Kalman, George W. Kalweit, A. B. Keepman, J. L. Kelley, Henry G. Koch, Otto O. Krause, Richard Krohn, O. J. Kruse, Stanley Kubiak, John P. Kuehn, James Lane, W. F. Lathrop, F. H. Lingnor, I. Bert Loeser, Frederick A. Luber, Edward Lutz, Alex. McConnell, David MacNaughton, Albert A. Meisenheimer, Nicholas W. Miller, J. D. Mortimer, George A. Parker, J. E. Partington, N. O. Smith-Petersen, George F. Plant, George G. Post, W. L. Radke, O. M. Rau, H. W. Richardson, M. J. Schieffer, E. C. Schmitz, C. J. Seydewitz, P. H. Siefert, Charles Smith, G. J. Spellman, G. O. Stearns, L. E. Stevens, M. D. Stevens, Lawrie Stroebel, W. H. B. Stocking, Wallace C. Stoneman, William Tellier, Charles T. Thompson, Harry B. Underberg, Herbert J. Van Haagen, George Waldman, Edward J. Watson, Theodore L. Wiese, Henry E. Weiss, Frank Weske, C. M. Wheelock, T. Wiesendanger.

British Columbia Electric Railway Company, Chilliwack, B. C.—C. A. Barnett.

Dominion Power and Transmission Company, Hamilton, Ont.—Glenn Marston.

Ottawa Electric Company, Ottawa, Ont.—W. H. McIntyre.

Toronto Electric Light Company, Toronto, Ont.—L. W. G. Watts.

Montreal Light, Heat and Power Company, Montreal, Que.—Albert H. Cleveland.

Quebec Railway, Light, Heat and Power Company, Quebec, Can.—A. P. Doddridge.

Highly Successful Meeting of the Canadian Electrical Association

At Niagara Falls, Ont., June 21-23, at the new Clifton House, facing the great cataract, the Canadian Electrical Association held its twenty-first annual convention, and the first meeting since its affiliation with the N. E. L. A. It was a brilliantly successful affair, and the attendance reached over 300. The convention was still in session when the BULLETIN went to press. A number of valuable papers were presented eliciting lively and pertinent discussion, and a notable item of the programme was the luncheon on Thursday to celebrate the coronation of King George V. On this delightful occasion, participated in by over 250 members and ladies, addresses were made by Mr. A. Monro Grier, K. C., vice-president of the Canadian Niagara Power Company, and Mr. Samuel Insull—an Englishman by birth—president of the Commonwealth Edison Company of Chicago. Both speeches were in every way worthy of the auspicious occasion, and elicited frequent applause.

The National Association was represented by President-elect Gilchrist and Secretary Martin, both of whom participated actively in the discussions. Mr. Gilchrist had a most cordial reception from the Canadian membership in convention and outside. A notable feature of the convention was the special trip of about 150 members of the Toronto Electric Light Company Section on Coronation Day, when the members were able to attend the morning session, join in the coronation lunch and see the afternoon aquatic sports at Chippewa-on-the-Lake. The weather was kindly throughout, and the meeting, especially as the beginning of a new regime of "reciprocity" between central-station men in the two countries, will be long remembered.

NEWS OF THE SECTIONS

WORK FOR THE COMPANY SECTIONS

One of the most interesting parts of the recent convention was that devoted to Company Sections and their work, associated with and following the excellent paper on bulletins by Mr. Edkins. The discussion was full and prolonged, but there were so many desirous to speak, it might easily have been continued. Many points of interest and value were brought out, all going to show how vital and useful the Company Section can be in promoting efficiency and loyalty and the general welfare of the corporation and its employes. Best of all was the terse and graphic summing up by Mr. Insull from the standpoint of one managing a large company. His remarks are given on another page, and are commended to the careful consideration of every member company, as well as of every member employe. That speech was a far-seeing recognition of the fact that the advance of the industry is the concern of all, and that through the agency of the Association when fully organized a tremendous influence for good can be exerted in every community and on public opinion generally. Every progressive company can toe the line marked by Mr. Insull.

President Freeman's address also emphasized the value and importance of Company Section work, and it will be noted that the amendments to the constitution printed elsewhere aim at benefitting the Sections and their members. One feature is that new members can come in at the half year, and pay only proportionate dues, while receiving full benefits from that moment. Another point is that Company Sections can now enroll also local members not directly employed by the company but interested in its work, and acting in friendly alliance. It is probably not the wish of all Sections to avail themselves of this privilege, but some Sections want it; and it goes without saying that no Section will desire to include in its ranks any whose attitude in is any way inimical to central-station interests.

Altogether, a fuller recognition has been given of the significance and importance of the Company Section, a larger elasticity has been given to its operations, and it will be surprising if the current year does not witness a notable expansion of Company Section membership, associated with the creation of many new Sections.

Mr. Insull on Company Sections

At the close of a long and very interesting discussion of Company Sections and their work, on the afternoon of May 30, at the recent annual convention, Past-President Samuel Insull, of the Association, president of the Commonwealth Edison Company of Chicago, said: "I consider when Mr. Doherty made the suggestion that we should establish these Company Sections he rendered a great service to the industry, that is, not only to the Association but also to the companies themselves. I naturally look at this matter from the point of view, to use the expression of this morning, rather of the 'master' than of the 'man,' although I try, whenever I am looking at things from that point of view, to also view it from the 'man's' point of view. I consider that from the company's point of view it is one of the most desirable things that has been brought into our business. I know of nothing that contributes so

to *esprit de corps* in an organization, that results in so close a feeling of relationship and loyalty to the organization, as the establishment of these Company Sections.

"It is much to be regretted that the greater part of the Company Section membership is confined to five or six of the larger companies. It is a class of work that can be extended right down to the smallest organization, the smallest electric lighting company that has membership in the national organization, and I think that if we want this organization of ours to maintain its virility we have got to look to the Company Sections to accomplish that. I think we should work at some scheme that will get representation of Company Sections at the National Convention. We tried to do it indirectly in Chicago (just as Philadelphia has tried to do it by one scheme and another) by bringing some of our Company Section members here. I myself am inclined to think that however desirable it may be to have close relationship between the Company Sections and the employes, say, of the electric contractors or allied industries, it would be a great misfortune to the Company Sections connected with the National Electric Light Association to admit the employes of those concerns, as the result might be a repetition of the unfortunate relationship that originally existed between supply people and manufacturers in the national organization. (Applause.)

"What we want to do, and what we want to do just as much for the benefit of the employe as for the employer, is to bind our people close to us by whatever method we think will bring about that result. Now, I know of no method that will bring about that result so much as educating the foreman or the lineman and fitting him to occupy an executive position. (Applause.) It has been done in the steam railroad business very extensively, so that to-day I think you will find that the greater part of the trunk lines of the country have as their executive heads men who have worked in section gangs when they first started in the railroad business. There is no reason why we should not bring about that same result in our business. I know of no better way of doing it than by the encouragement of Company Sections amongst all of our company members, and I think that the main effort of the coming executive, next year's administration, should be in the same direction as the wonderful efforts made by Mr. Freeman and his fellow officers during the past year in encouraging the Company Section membership, and I am sure if the work is followed out we will have a very large number of these sections and they will be of great benefit alike to the companies themselves and to their employes.

"While I appreciate that you cannot get men together in a room, say, once a month, who have been hard at work all day unless you provide them with some form of entertainment, I think there should be some continuity of policy as between the executive officers of this organization and the various Company Sections throughout the country. I think there ought to be a proper exchange of all classes of information. I do not know exactly how it could be worked out most economically, because, after all, all these things cost money, and while we have a vast and influential organization, and can raise large amounts of money for special purposes, the regular income of the Association is ridiculously low, if you look at it from the point of view of the importance of the organization;

but there ought to be some method of exchanging the ideas, exchanging the papers and ensuring continuity of policy.

"A subject that we are all of us vitally interested in, that affects our very existence, is our relations with the public. We are subject to all kinds of attacks. It has been stated here that we have, say, about 65,000 employes of the member companies of this Association. I think that is low. I think that a fair estimate is nearer about 100,000 employes. The experience of Brooklyn, New York, Chicago and Philadelphia shows that we could count on about 40 per cent of our employes becoming members of the Company Sections. Suppose we have 100,000 employes spread throughout this vast continent, and as we are reminded by the flags that it is my pleasure to see here, they are on both sides of the line. What would be the effect on public opinion if, say, 40 per cent of that number had a proper understanding of the questions governing cost and selling price, of the relations of capital and labor, of the relations of the community to our business, of the serious effect upon the cost of our products to our consumers if we suffer from adverse legislation and cannot obtain money at a fair price? Questions of that kind could be discussed in our Company Sections. It can be done either by the men inside the organizations, or there are lots of men throughout the country who are very glad to give their time to properly enlighten us and our employes on those subjects. I repeat again I think it is of vital importance alike to the National Electric Light Association and to its company members and their employes to push this movement to the greatest possible success." (Applause.)

Annual Meeting of the Philadelphia Section

The annual meeting of the Philadelphia Electric Company Section was held Monday evening, May 15, 1911. The entire time of the meeting was taken up in the election of officers for the coming season and the chairman's annual report, which consisted of a review of the work of the past season and a summary of the reports of the various committees.

Mr. Israel advocated that, in order to strengthen the membership and increase the attendance, the meetings of the various departmental branches be so arranged as to come in different weeks, also that care be taken to avoid the coming in conflict with meetings of other engineering societies in which the members may be interested.

He commended the special committee on the revision of the Constitution, stating that with a few minor changes to meet local conditions, the constitution as adopted by the local section would be adopted by the national association as a standard form of constitution for Company Sections.

It was also stated that very complimentary comments had been received regarding the Section emblem, and that the buttons were in great demand.

The secretary's report mentioned that all the Section meetings are strictly business meetings, the social feature being avoided, and recommended that greater benefit could be obtained by the individual members and more credit by the Section if such practise were continued.

The report of the Papers and Meetings Committee showed that the attendance had increased 58 per cent during the season.

The Publication Committee has the responsibility of keeping up the high standard of *Current News*, the

circulation of which in nine issues amounted to over 9000 copies. The "Question Box" might be considered as subsidiary to *Current News,* as it is one of the main features of the publication. The report of the committee set forth the number of questions that had been received and answered, it being very interesting to note that all departments took an active interest in the "Question Box."

The report of the Library Committee showed that the library was able to comply with 92 per cent of the requests for books, periodicals, etc.

The Membership Committee at the early part of the season appointed a sub-committee, the report of which was included with the report of the committee. The excellent work that had been done during the past season was accredited solely to the hard and earnest work of the sub-committee. The membership of the Section has increased in the past season 87 per cent, which is a most excellent showing when it is considered that no inducements outside of the educational features are offered to members.

The Prize Award Committee announced in detail all the suggestions received during the past season, for which there were awards of 16 prizes. All suggestions that had been received were under consideration by the heads of the different departments to which they applied.

The Departmental Branches Committee reported that three branches had been formed during the past season as follows: Meter, Accounting and Commercial, all of which are in a flourishing condition, and holding regular monthly meetings. The papers presented at the meetings of the branches are devoted to their particular lines of work, which naturally make them of vital interest to all in attendance. This permits the meetings of the local Section to be devoted to general topics, which are selected so as to be of interest to the Company members at large. This method of procedure has proven very successful, and it is suggested that this be continued to even a greater extent during the coming season.

The following officers were elected to serve for the ensuing year: Chairman, Thomas Sproule; vice-chairman, R. B. MacCreery; secretary, B. Frank Day. Executive Committee: Two-year term—J. T. Maxwell, J. D. Israel, C. J. Russell, Jos. B. Seaman; one-year term—Geo. Ross Green, P. H. Bartlett, A. H. Mainwaring, A. R. Granger.

The treasurer and three members of the Executive Committee are to be appointed by the president of the Philadelphia Electric Company.

An amendment to the Constitution was adopted, providing for the appointment of two honorary members to the Executive Committee. There were in attendance 116 members.

Papers Before the New York Section

Fully recovered from its active participation in all the work and hospitalities of the recent convention, the New York Companies Section held a large meeting in the Edison Auditorium on June 19, when the regular programme consisted of papers held over from the last meeting, when time lacked for their reading. The items were as follows:

1. "Securing Business on the Installment Plan, Its Advantages and Disadvantages," paper by A. A. Pope; discussion led by W. J. Meara and E. A. Mills.

2. "Value of the Electrical Sign as a Business Getter," paper by Jesse Richards; discussion led by W. D. Jones and E. F. Tweedy.

3. "Value of the Show Window as

an Advertising Factor," paper by Joseph F. Becker; discussion led by C. L. Law and Charles Le Claire.

4. "How Best to School Our Commercial Men," paper by F. C. Henderschott; discussion led by C. A. Littlefield and W. L. Secord.

This substantial fare was followed by other refreshments and by entertainment of a musical character. There were many felicitations on the growth of the section in reaching over 1500 members.

Troubles Overhead and Underground

A very interesting meeting of the Boston Edison Company Section was held in Boston on June 8, presided over by Mr. R. E. Curtis, chairman of the Section. The subject for discussion was: "Trouble on Overhead and Underground Lines." Mr. James A. Vahey treated the line or outside aspect of the subject, and Mr. Pierce Kent, chief operator of the alternating-current system, dealt with the matter from the station standpoint. The discussion throughout was of a most practical character, and an excellent summary of it may be found in the *Electrical World* of June 15, which devotes nearly two pages to it.

Treatment of Shocks and Burns

The fourth regular meeting of the Allegheny County Light Company Section, Pittsburgh, Pa., was held at the Rittenhouse, Pittsburgh, on May 23, with 200 members present. Dinner was served at 6.30 P. M.

After a short musical programme, Dr. Charles A. Lauffer, medical director of the relief department, Westinghouse Electric and Manufacturing Company, delivered a lecture on "Resuscitation from Electrical Shocks and Treatment of Electrical Burns"; following his address with a practical demonstration of the "prone pressure" method; dwelling on its simplicity and the ease of operation, saying that it is possible for a boy of twelve years to produce, without fatigue, artificial respiration in a grown man for an hour. After the lecture and demonstration, about 60 members were personally instructed by the physician in the use of this method, performing the operation on one another for practise.

The meeting was one of the most enthusiastic yet held, the subject being one close to the hearts of men in the electrical fraternity. Its practical value to employes of central stations in general cannot be questioned.

What the Commonwealth Edison Section is Doing

The Commonwealth Edison Company of Chicago is one of the most active of the "Sectors," and evidences every intention to outdo in the coming year whatever it may have done in the past. At the meeting of the Section on June 13 Chairman E. F. Smith announced that the membership had then reached a total of 1188, which is the largest of any individual Company Section in the Association. Mr. John F. Gilchrist, the president elect of the National Electric Light Association, gave an interesting address on the mercantile business of the company. He also described the benefits of the employes' savings fund. Employes of the company may invest in this fund. By allowing their savings to accumulate for a term of five years the principal and accrued interest compounded at 6 per cent may be invested in the company's stock at par. Inasmuch as this stock is now selling on the market at about 128 and 129, the result for the five-year period is an excellent investment for the employes, and will net, approximately, 16 per cent to 20 per cent a year, provided the stock is selling at the end of the

period at about the present market price. Mr. Gilchrist made an earnest plea for the support by the Section during the coming year of the Association's activity.

Reports on the recent New York convention were presented by Messrs. E. W. Goedjen, G. A. Freeman, Joseph H. Perry, John G. Johnson, E. A. Edkins, R. F. Schuchardt and E. W. Lloyd. The last-named called particular attention to the great value of the papers and reports read at the New York convention, and the fact that only a few members of the Section had enjoyed the opportunity to read and assimilate them as yet. In order that greater benefit may be obtained from these papers, Mr. Lloyd announced that several of the departments of the company would hold meetings in the future at which convention papers pertaining to the work of that department would be abstracted and discussed.

A pleasant feature of the evening was the presentation by Mr. Peter Junkersfeld of gold-button badges to Messrs. George H. Jones, J. C. Manley and Ernest F. Smith, who have served as chairmen of the Section. Resolutions of condolence on the death of Mr. Robert D. Ferguson were adopted. Mr. Ferguson, who was formerly connected with the company and had taken up new duties with the central-station company at Evansville, Ind., was drowned a few months ago while boating on the river there. The meeting was concluded by some excellent music given by the N. E. L. A. orchestra of the Section.

The Question Box in Salt Lake City

The Utah Light and Railway Company Section, Salt Lake City, is making a feature of taking up at its regular meetings certain questions in the *Box*, and finds this a useful and stimulating exercise. The last meeting reported was that of May 24, when a number of topics were thus taken up, the answers being read and discussed in open meeting. It would seem that such a practise might well be followed in other sections as a part of the educational work, as in this way additional light can be thrown on many perplexing problems that are encountered in the course of daily work in different departments of a central station enterprise, whether the company be large or small.

Milwaukee Section Elects Officers

At the annual meeting of the Milwaukee Electric Railway and Light Company Section, the following officers were elected: President, O. M. Rau; vice-president, A. H. Sikes; secretary, G. G. Post; treasurer, F. J. Boehm; director, three years, Eggert Douglas; director, two years, C. N. Daffy; director, one year, R. H. Pinkley; director, ex-officio, J. D. Mortimer. The Section has grown rapidly this year, and will start on an active campaign and winter season next September, when it is expected to show a large increase in membership.

Denver and Doherty

One of the most interesting of the recent meetings of the Denver Company Section was that in the spring, when Mr. Frank W. Frueauff gave a detailed account of the Doherty organization, its methods of operation, and of the companies or systems it controls and manages. It was a striking revelation of growth and of the possibilities of the business. As to the Section itself, Mr. Frueauff said he was proud of its work in developing latent talent, so much of which is now finding careers in the Doherty ranks.

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . **360 Pearl Street, Brooklyn, N. Y.**

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

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EDITORIALS

QUESTION BOX CLASSIFICATION

FUTURE OF THE QUESTION BOX

A recommendation was made in the report of the *Question Box* editor to the New York Convention that the *Question Box* in future be conducted directly by the Association through some competent individual employed for the purpose, rather than, as in the past and present, by a succession of central station editors. It is felt by the present editor that the Association should assume the responsibility for this important function of the organization rather than shift the burden to any individual member or member company.

The balance of the report expressed the editor's enjoyment of his year's *Question Box* work, and indicated the Association's obligation to the many contributors, whose continuous co-operation made possible the maintenance of a high standard of service.

From the Commercial Section and from other sources, during the convention, came a request to the Association for the establishment of a bureau of information where members could be assured of finding, properly classified, in immediately available form, data on the varied phases and activities of the business, likely to prove helpful either in emergencies or in the contingencies that are daily arising in connection with central station work. For instance, if a central station in attempting to close a contract with a laundry or shoe factory required immediate information on the subject of electric drive in these enterprises, together with a list of central stations having such customers, and the conditions of supply, this bureau of information should be able to furnish the desired knowledge immediately upon application. Or again, a station threatened with competition or municipal ownership might apply and receive accurate information applicable to the situation, and suggestions or advice drawn from the experience of others. The wide field such a bureau would be enabled to cover, and its usefulness to members, must be apparent.

It seems to us that the establishment of such a bureau is advisable, and also that the *Question Box* could appropriately and advantageously be conducted by or in connection with it. The two activities would dovetail, and the combination suggests itself as natural and expedient. Carry out this conception in the right way and results to the Association cannot fail to be satisfactory. As to cost, the expense would be moderate, and, besides, it is not becoming and should not be necessary for an Association of 9000 members representing an industry with two billion dollars of invested capital, to be niggardly.

All of which is respectfully submitted to the source from which action must come.

HELPFUL HEATING DATA

Particular attention is called to the replies to question 21—28 in this issue and also in the May issue of the BULLETIN.

This inquiry requests such data on heating different kinds of buildings as is likely to prove of value in superseding isolated plants with central-station service.

The importance of codification and correlation of such information, as amassed by central stations which have been scientifically seeking this kind of business, cannot be over-estimated, and the replies so far received indicate the comprehensiveness with which some companies have been working out the problems involved, and the liberality with which they are willing to place their facts and figures at the disposal of their fellow members.

Some valuable information was given in the May issue in contributions from New York, Chicago and Providence. In this issue a great deal of space is given up to contributions from Mr. De Wolf, of Rochester, Mr. Miller, of St. Louis, Mr. Boyden, of Boston, and others.

We feel that the special acknowledgments of the Association are due to these gentlemen. We are sure our readers will agree that the importance of this subject and the value of the information furnished more than justify publication of these replies in full. It would seem as if no power engineer or member of the commercial staff of any central station could fail to profit by a study of these contributions.

METER READINGS ON BILLS—SHALL WE ELIMINATE THEM

Attention is called to question 23—40 and the replies published in this issue, because, while apparently not a subject for controversy, insomuch as at first glance there would seem to be only one possible attitude to assume in connection with the question presented, it develops that there are really two sides to the matter, even if the minority side is represented up to date by only a single contribution.

The question suggests the advisability of eliminating meter readings from monthly bills so that bills would only show net kilowatt hours consumed, rate and amount due in money.

The minority reply comes from Mr. E. C. Deal, of Augusta, Ga., who believes that it would be good practise to eliminate meter readings, and who speaks from experience, having tried both ways.

Mr. Deal supplemented his official *Question Box* answer by a personal letter of explanation: In this letter the arguments for his method are ingeniously set forth, and we are sure the writer of this communication will have no objection to the publication of the following quotation:

"With a system of this kind it is customary to carry the monthly meter readings on what is termed a ledger card, and only the amount of the bill in dollars and cents, payments, rebates, etc., appear on the customers' ledger. This enables the complaint clerk to deal with the consumer without interfering with the customers' ledger, and by referring to the card case, presents immediately and quickly the meter readings in intelligent form from the date the system was first put in use, which may be any number of years, and which will enable the consumer to trace his readings back intelligently for any period and convince himself as to the accuracy of the meter readings.

"It is very seldom that a consumer keeps his bills in such shape that he can with dispatch get his monthly readings in intelligent shape covering a period of one year, and it is more convenient for him to call up on the 'phone and ask for his meter readings.

which can be given him over the 'phone, by messenger or by mail, without interfering in any way with work being done on the customers' ledger.

"By eliminating the readings from the bill you eliminate certain chances of error in the way of copying figures, carrying out extensions and going wrong on constants, and one error of this kind would shatter the consumer's confidence in the bookkeeping methods for a long time and will result in his attempting to read his own meter and figure his own bill and get himself confused, owing to the difficulty in making intelligent comparisons for past months on account of previous bills being mislaid. This method does not prevent the consumer reading his own meter from month to month. In fact, he is not interested so much in the indications shown on the dial of his meter as he is in the net kilowatt hours, and he is not so much interested in the net kilowatt hours as he is in the dollars and cents shown on the bill, and when the amount of money seems out of proportion, the easiest thing for him to do is to refer to the net kilowatt hours shown on his various bills for the past, and if that is not right, he should then refer to the office instead of trying to refer back to his various meter readings. If he should attempt to refer back to his meter readings for a period covering a year or more, he will in many cases become so confused that he will lose all confidence in your bookkeeping methods in that they seem to him to be unduly complicated.

"Out of approximately three thousand consumers in Greensboro, N. C., we only had two complaints when we went from the old to the new method, and it took less than five minutes to convince and win these two parties over to the new method. One of these parties was the mayor of the town and the other was the head of a big cigar factory and was also a large dealer in horses; in other words, were men of good business judgment and training. It would therefore seem short-sighted for central-station companies to condemn this method abruptly without first giving it due consideration, and I believe that if investigation is made first and decision reached later by progressive companies, it will be in general use before a great while. The further fact that one of the biggest operating companies in the United States has to-day adopted it in different places would indicate that it deserves some consideration."

What Mr. Deal says about consumers seldom keeping their bills and accounts in such shape as to be able to make quick comparison of monthly readings may be true of small cities, but we doubt if it is true of the average customer of the large station. A considerable percentage of customers in large cities make careful comparisons and pay very particular attention to meter readings as reported on their bills, and this frequently results, as pointed out by Mr. Spencer, of New York, in detecting meter readers' errors.

It does not seem to us that the advantages suggested by Mr. Deal are of sufficient importance or value to counteract the unpleasantness likely to result in any large city from a discontinuance of the present nearly universal practise. The present-day tendency is to supply the customer with all the information reasonably possible, and to impress him with the fact that the lighting company has nothing to conceal, and that its every act and practise is open and above board, so that he who runs may read. It seems more important to conserve and strengthen this impression, than to save some small trouble or slight expense in a detail of accounting.

However, this is only an individual opinion, and as Mr. Deal puts it, the matter is worthy of a more careful consideration than it has generally so far received. Further contributions of experience or opinion on this subject will be welcomed.

THE KILOWATT YEAR

The replies to question 23—39 as to how many kilowatt hours there are in a kilowatt year are interesting, and should be of value as presenting the dicta of authority on this subject, which has been one of occasional controversy in the past. It is always well in a matter of this kind to clarify the atmosphere and crystallize conviction by means of a consensus of authentic information from reliable sources.

ANSWERS

BOILERS, ENGINES, TURBINES

3—7. Given the following conditions: A non-condensing plant consisting of a 4-valve engine belted to a 150-kilowatt generator and a cross-compound Corliss engine (ratio of cylinders 3½ to 1) direct-connected to a 250-kilowatt generator. Company has surface wells that will furnish three or four times as much water (very hard) as is required for the boilers. The small unit has practically a full load for 24 hours per day and the large unit is loaded for about six hours per day. Would it pay to install a condenser and cooling tower to get good water for the boilers? Would the condenser and tower pay from an economy standpoint?

(Other answers in February and March BULLETINS.)

John Anderson, Assistant Chief Engineer, Union Electric Light and Power Company, St. Louis, Mo.—Cost of coal in case under consideration, $2 per ton.

PLANT OPERATED NON-CONDENSING.

Four-valve engine belt-connected to 150 k.w. generator loaded to capacity 24 hours per day.

$$\frac{\text{26 lbs. water per IHP}}{\text{82\% Eff. eng. and gen.} \times .746} = \text{42.5 lbs. water per k.w. hour.}$$

$$150 \times 42.5 = \text{6375 lbs. water per hour.}$$

$$\frac{6375}{\text{4½ actual evap. per lb. coal}} = \text{1417 lbs. coal per hour.}$$

$$\frac{1417 \times 24 \times 365 \times \$2}{2000} = \text{\$12,412.92 cost of coal per year.}$$

Compound Corliss direct-connected to 250 k.w. generator loaded to capacity 6 hours per day.

$$\frac{\text{22 lbs. water per IHP}}{\text{82\% Eff. eng. and gen.} \times .746} = \text{36 lbs. water per k.w. hour.}$$

$$250 \times 36 = \text{9000 lbs. water per hour.}$$

$$\frac{9000}{\text{4½ actual evap. per lb. coal}} = \text{2000 lbs. coal per hour.}$$

$$\frac{2000 \times 6 \times 365 \times \$2}{2000} = \text{\$4380 cost of coal per year.}$$

$12,412 + $4380 = $16,792 Total cost of coal non-condensing per annum

PLANT OPERATED CONDENSING.

150 k.w. loaded 24 hours as before:

$$\frac{\text{21 lbs. water per IHP}}{\text{82\% Eff. eng. and gen.} \times .746} = \text{34.3 lbs. water per k.w. hour.}$$

$$150 \times 34.3 = \text{5145 lbs. water per hour.}$$

$$\frac{5145}{\text{5 lbs. actual evap.}} = \text{1029 lbs. coal per hour.}$$

$$\frac{1029 \times 24 \times 365 \times \$2}{2000} = \text{\$9014 cost of coal per annum.}$$

250 k.w. loaded 6 hours:

$$\frac{17 \text{ lbs. water per IHP}}{82\% \text{ Eff. eng. and gen.} \times .746} = 27\tfrac{3}{4} \text{ lbs. water per k.w. hour.}$$

$$250 \times 27\tfrac{3}{4} = 6937 \text{ lbs. water per hour.}$$

$$\frac{6937}{5 \text{ lbs. actual evap.}} = 1387\tfrac{1}{2} \text{ lbs. coal per hour.}$$

$$\frac{1387\tfrac{1}{2} \times 6 \times 365 \times 2.00}{2000} = \$3038 \text{ cost of coal per annum.}$$

$9014 + $3038 = $12,052 Total cost of coal condensing.

COSTS COMPARED.

	Non-Condensing	Condensing
Coal for 150 k.w. generator per annum	$12,412.00	$9,014.00
" " 250 " " " "	4,380.00	3,038.00
Cost of operating 10 h.p. circ. and air pump at 70 lbs. steam per hr. 24 hrs. per day		894.00
Cost of operating 15 h.p. motor 7½ k.w. av. 24 hrs. at 6/10 cts. per k.w.		394.00
Extra firing labor required one man on one watch ..	720.00	
Int. and Depr. 15% on condenser and cooling tower equipment cost $7,600 installed		1,140.00
	$17,512.00	$14,480.00

$17,512 — $14,480 = $3032 Saving by operating cooling tower.

COST OF CONDENSER AND COOLING TOWERS.

16/100 sq. ft. cooling surface required per lb. steam per hour to give 26" vacuum $= 5145 + 6937 = \dfrac{12{,}082 \times 16}{100} = 1933$ sq. ft.

Size of standard condenser, 2000 sq. ft.

Cost of Condenser, air and circulating pumps erected	$3,000.00
" " 12½" dia. cooling tower, fan and motor erected	3,000.00
" " Foundations	100.00
" " Pipe work	1,200.00
" " Oil separator	300.00
	$7,600.00

Feed water cost in non-condensing method will equal cooling tower make-up in condensing method. Water for boilers will be free from scale-forming material in condensing operation, making boiler cleanliness and efficiency much greater, possibly 10% saving in coal as shown in actual evaporation figure.

Total saving = $3032 with coal at $2 per ton.
" " = $1306 " " " $1 " "

4—4. On what slope (minimum) will slack coal run? Does slope vary for open or closed chutes?

Allegheny County Light Company Section, Pittsburgh, Pa.—Dry slack coal will run on angle of 30 degrees, but it is preferable to have this angle as near 45 degrees as possible, as wet slack has a tendency to "stick" even on a perfectly smooth surface.

G. L. Knight, Designing Engineer, Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.—The safe slope for figuring the run of slack coal in closed chutes of ample size should not be less than 50 degrees, and greater where possible. The chute should be straight, if possible, and where necessary to make bends, they should have very long sweep ells, as slack coal has a great tendency to pack where its course is changed. The angle of repose of soft coal is often almost 90 degrees from the horizontal if

undisturbed, although, of course, a slight jar will bring it down to 30 or 40 degrees, depending upon its condition as regards moisture. The slope would vary as between open or closed chutes, only because the open chutes would be accessible if the run of coal were stopped.

7—7. Will some member company, who has low-pressure turbines, kindly furnish some data on the following proposition:

If a reciprocating engine and generator carrying 3200 kilowatts with a 28-inch vacuum takes a water rate of 18.9 pounds per kilowatt-hour, what would be the water rate if a low-pressure turbine was connected to the engine, exhaust vacuum remaining the same, and the engine-driven generator delivering its full 3200 kilowatts and the low-pressure turbine delivering approximately 2000 kilowatts?

H. G. Stott, Superintendent Motive Power, Interborough Rapid Transit Company, New York.—In view of the fact that I have no data as to the specific type of engine, what the cylinder ratio is, etc., it is impossible to give an exact answer to your question, but in general, I should say that there would be an improvement in economy by the additional of a low pressure turbine, approximately 15 per cent in the water rate.

Edwin D. Dreyfus, Commercial Engineer, The Westinghouse Machine Company, East Pittsburgh, Pa.—There should be an improvement in economy of about 20 per cent, or slightly more. The initial pressure of the turbine, however, should be about 11 pounds absolute, so that the turbine, in developing 2000 kilowatts, will just consume the exhaust of the engine on a load of 3200 kilowatts, and thus avoiding a possibility of any receiver (between engine and turbine) steam blowing to the atmosphere through the relief valve.

Allegheny County Light Company Section, Pittsburgh, Pa.—Your actual rate with the combined engine-turbo unit should be between 15 and 16 pounds per kilowatt-hour. It is assumed that you use saturated steam at 150 pounds gauge.

7—8. Will member companies who have Parson's Type Turbines kindly give experiences they have had with steel blading and with steel, copper-plated blading, also, member companies who have Curtis Turbines give experiences they have had in regard to trouble with nozzles and blading corroding?

Edwin D. Dreyfus, Commercial Engineer, The Westinghouse Machine Company, East Pittsburgh, Pa.—It has been noticed in some localities that steel blades were virtually unaffected by a corrosive action of the steam, while in a few sections a pronounced dèterioration took place. Peculiar chemical conditions, caused by ingredients of the water, explain the cause of the latter, and in reporting any case of this kind, the properties of the water, and possibly any water purifying compounds used, should be included.

J. B. Mahoney, Superintendent, Connecticut River Power Company, Vernon, Vt.—In four years' experience with 500, 1500 and 2000 kilowatt Curtis turbines, the writer had no difficulty with nozzles or blades corroding.

GENERATORS, CONVERTERS, SWITCHBOARDS INSTRUMENTS

10—44. What effect has power-factor on efficiency of generators, distribution, motors?

(Also answered in May BULLETIN.)

Donald Bowman, Commonwealth Edison Company, Chicago, Ill.—The efficiency of a generator is lowered in two ways:

First: The kilowatt output is lowered, since the quantity of current, rather than the power delivered, is what limits the output of a machine.

Second: The field of the generator is demagnetized by a lagging current. This makes an excessive magnetizing current necessary, and increases the $I^2 R$ losses in the field.

In case of a transmission line, the kilowatt carrying capacity is also cut down by low power-factor, and the $I^2 R$ losses are increased.

Inductance in a transmission line is not always a desirable thing to eliminate. On transmission lines, where an over-excited synchronous motor is floated at the far end in order to boost the voltage at that point, inductance in the line is so necessary that, where it is lacking, reactances are inserted into the line in order to get the necessary inductance.

J. B. Juhnke, Chief Load Dispatcher, Commonwealth Edison Company, Chicago, Ill.—A low power-factor is extremely detrimental to the efficiency of the above equipment, singly and jointly. Its bad effects manifest themselves in large wattless current components responsible for excessive $C\ r$ losses, reduced output and consequent reduction of efficiency.

On generators, specifically, the bad effects consist of increased heating losses due to this displaced current component, and, if same is lagging, as is the most common case, in excessive armature reaction calling for abnormally increased field current.

In distribution systems the increased losses are primarily $C\ r$ losses, resulting in heavy potential drop and a like reduction of efficiency. Similar statements hold for motors, though maximum efficiency does not necessarily coincide with maximum power-factor.

From the point of view of the central station men, unity power-factor in each part is certainly the ideal condition, though scarcely attainable without excessive expenditures.

S. N. Clarkson, Power Engineer, Union Electric Light and Power Company, St. Louis, Mo.—The efficiency of all alternating current equipment is lowered by the reduction in power-factor, but the loss in efficiency is greater when two machines or circuits of the same kilowatts true energy are compared than when the same KVA capacities are considered. Even when the KVA and consequently the line current remain unchanged, the iron and the field copper losses in motors and generators would be increased by a reduction in power-factor, but to what extent will depend upon the design of the machines. For the sake of simplicity, only the armature or line copper loss is considered in the following examples. This puts motors and generators in the same class with any alternating current circuit in comparing efficiencies at different power-factors.

EXAMPLE I.

K.w. (true energy) constant.

Find the efficiency of a 900 k.w. machine at 60 per cent power-factor if it is 89 per cent efficient at 90 per cent power-factor.

Energy input at 90 per cent power-factor $= \frac{900}{89} = 1011.34$ k.w.

Loss at 90 per cent power-factor $= 1011.34 - 900 = 111.34$ k.w.

For any given k.w. capacity, the copper loss varies inversely as the square of the power-factor. Therefore the loss at 60 per cent power-factor will be

$$111.34\left(\frac{90^2}{60^2}\right) = 250.54 \text{ k.w.}$$

Efficiency at 60 per cent power-factor $= \frac{900}{900 + 250.54} = \frac{900}{1150.54} = 78.22$ per cent.

In the case of generators, the prime mover efficiency would be unaffected by the change in power-factor, provided the same number of machines were in operation.

EXAMPLE II.

KVA (apparent energy) constant.

Find the efficiency of a 1000 KVA machine at 60 per cent power-factor if it is 89 per cent efficient at 90 per cent power-factor.

1000 KVA 90 per cent power-factor is equivalent to 900 k.w.

The loss at 89 per cent efficiency will be 111.34 k.w., as in Example I.

1000 KVA 60 per cent power-factor is equivalent to 600 k.w.

As the line current remains the same, the loss will be the same for both power-factors.

The efficiency at 60 per cent power-factor $= \frac{600}{600 + 111.34} = \frac{600}{711.34} = 84.77.$

The prime mover efficiency would in this case be reduced by the reduction in power-factor and should be taken into consideration where generators are concerned.

10—45. At a certain station the equipment is loaded to the limit the greater part of the day, and at times the equipment is inadequate to supply the peak loads, which are more than momentary. The generators are driven by steam engines. Which would be the more economical and efficient to make up this deficiency, to install a synchronous motor, or an induction generator connected to an exhaust turbine? The latter, of course, would run idle except during heavy load periods when the maximum exhaust steam is delivered to turbine and runs same as an induction generator.

(Other answers in May BULLETIN.)

S. N. Clarkson, Power Engineer, Union Electric Light and Power Company, St. Louis, Mo.—If the present steam equipment is inadequate, it would probably be best to add a low pressure steam turbo-generator set to get the desired increase in capacity. An asynchronous generator cannot be used as suggested unless the power-factor of the system is near unity, as with a rotary converter load. So much lagging wattless current would be taken from the synchronous generators on a low power-factor load, that they are not likely to have sufficient capacity to supply the additional wattless current required to excite an asynchronous machine.

On the other hand, if the low power-factor of the load makes the alternators responsible for the limited capacity of the plant, it could be increased most economically and for the smallest initial outlay by the use of over-excited self-starting synchronous motors.

Before specific recommendations can be made, complete information must be available on the plant equipment, distribution and character of the load, what suitable loads are available for synchronous motors, and at what location on the lines these motors could be installed.

10—46. Will it be possible to obtain a light or get a reading of voltage between the phases of two alternating-current machines which are not tied in together on a system, machines being 3-phase, 4-wire type? Why?

R. M. Stevenson, Brooklyn, N. Y.—Yes; because the frames of the machines will act as one plate of a condenser, the insulation as the dielectric, and the windings as the other plate, thus giving a condenser effect; therefore, a small current could be obtained between the two machines.

If the neutrals of these machines were grounded it would be possible to get a current between the machines, regardless of the condenser effect. In this case a very heavy current could be obtained.

E. A. Holtorf, Edison Electric Illuminating Company of Brooklyn.—It will be possible to obtain a reading of voltage between the phases of two 3-phase, 4-wire machines not tied together on a system. The machines not being tied together are not in synchronism, and the frequency of the machines would vary slightly from each other. Hence there would be instants of time when the + maximum of one generator would coincide with the 0 or — minimum of the other generator, giving a difference of potential, and, from Ohm's law, a current would flow if connection was made. The above holds true only when the neutral wire of each machine is grounded. If the neutral is not grounded in both cases, no reading could be obtained, because the circuit could in no way be completed.

Arthur H. Ford, Consulting Engineer, Iowa City, Iowa.—In general, it will not be possible to get a reading on a voltmeter connected to two machines under the conditions described, but if the neutral points of the machines are grounded, as is frequently the case, the voltmeter will give a pulsating indication, the frequency of the pulsations being equal to the difference of the frequencies of the generators.

J. B. Mahoney, Superintendent, Connecticut River Power Company, Vernon, Vt.—Yes, if the neutrals, or fourth wires, are grounded; or if there is a ground on any phase of both machines.

10—47. If the oil switch on the alternating-current side of a rotary converter opened as the result of a surge, or other reason, and the direct-current switches opened, would there be any bad effects from throwing the oil switch in again before the machine slowed down appreciably, without any further changes, such as pulling the field switch or throwing the alternating-current switches to the starting tap of the transformers?

J. L. Burnham, D. C. Engineering Department, General Electric Company, Schenectady, N. Y.—From the nature of the question, I assume that the machine is arranged for starting directly from fractional voltage taps on the transformers. If the alternating-current switch were thrown back in, it should necessarily be done immediately when it trips out, so there could be no possibility of the rotary getting out of phase. It requires a very short interval for the machine to get out of phase sufficiently to take a very large surge in current when thrown back in. This surging current creates a large armature reaction, which shifts the field flux and causes sparking at the brushes. This surge of current and resultant sparking may be obtained when starting from the alternating-current end, if the starting switch is thrown over slowly from the lower voltage to the higher voltage. It is, therefore, recommended that starting switches be thrown over quickly. When a machine is at full voltage, the sparking at the brushes would cause the machine to flash over, if the phase relations do not coincide closely when the switch is thrown in. The chances of an arc-over are much greater with a 600-volt machine than with a 300-volt, but in case the machine did not arc-over when badly out of phase, it might lock in step with the wrong polarity for paralleling on the direct-current side. In conclusion, it is not safe to throw the alternating-current switch back when it is tripped out, but the operator should go through the regular procedure of alternating-current starting, getting the machine in phase, and the field excited on the lowest voltage starting tap before throwing on the line voltage.

F. D. Newbury, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.—If the rotary converter is started as outlined in the question, by throwing on full voltage with the converter out of synchronism, a considerably greater current will be taken by the converter than when starting from the normal starting voltage. The fact that the converter would be only slightly out of synchronism does not seem to have much influence on the current taken, since, during starting, the current is approximately constant until synchronism is reached. Starting the converter with the field circuit closed is of advantage rather than otherwise, providing the direct-current exciting voltage is well up to normal, as would be the case under the conditions outlined. The field circuit being closed will increase the forces tending to bring the converter into synchronism and will insure the converter coming in, with correct polarity.

It is the practise in one station with which the writer is familiar to so interlock the direct-current and alternating-current circuit breakers, that the alternating-current breakers automatically disconnect the alternating-current side of the converter from the line whenever the direct-current breakers are open. This minimizes the danger from bucking. With this arrangement there is no difficulty in starting the converter in the manner outlined in the question, except that the alternating-current switch is first closed to the normal starting position. This can be done with so little increase in time, that it would seem unnecessary to incur the disadvantage of the larger starting current involved in connecting full line voltage immediately to the converter. These statements refer only to the rotary converter designed to start from low voltage directly connected to the converter armature. When the converter is started by a separate starting motor, and is not provided with a pole damper winding of suitable design for self-starting, it will be possible to start in the manner specified, providing the alternating-current switches are closed immediately and the increased starting current, due to the full voltage, is not objectionable.

S. N. Clarkson, Power Engineer, Union Electric Light and Power Company, St. Louis, Mo.—Closing the oil switch on the alternating-current side of the rotary would do no harm under the conditions mentioned, but it might be found necessary to shut down completely and start up again in order to get direct-current voltage in the right direction. The armature would be so strong with the full alternating-current voltage applied, that throwing over the field switch would not reverse its polarity.

H. W. Scovel, Chicago, Ill.—To close the oil switch with conditions as

stated in the question might do serious damage to the rotary or its equipment, because the chances are very great of the oil switch closing at an instant when the alternating-current voltage of the rotary and the line voltage have not the proper phase relation. The rotary should be started again in the usual way.

J. B. Mahoney, Superintendent, Connecticut River Power Company, Vernon, Vt.—I have done this in a few cases of emergency without any ill effects, but would not advise it as a regular practise, as it subjects the converter to unnecessary strains in pulling into synchronism. A better method would be to first open the field switch, then close the alternating-current oil switch.

Allegheny County Light Company Section, Pittsburgh, Pa.—There would be decidedly some bad effects, due to the fact that the rotary in all probability would not be in synchronism with the voltage on the 'bus. If there are other machines in parallel with the rotary, it would be most likely that their breakers would open too. When a rotary is started from the alternating-current side, by means of taps upon the transformers, it starts with the field broken up by a "break-up" switch. This makes it an induction motor. When it comes up to synchronous speed, and the main field switch is closed, it then becomes a synchronous motor, and the alternating-current breaker cannot be closed with the full field on, unless the machine is properly synchronized.

10—48. It is desired to supply 110-220-volt electrical energy for lighting from one generator. Under what conditions should

1. A 3-wire generator be used?

2. A 2-wire generator and a balancer set?

R. M. Stevenson, Brooklyn, N. Y.—Some prefer the three-wire generator for small plants because of smaller floor space required, but I believe that the greater ease in securing repair parts, better voltage regulation on unbalanced loads, and the ability to raise the voltage on the heavily loaded side to maintain balanced pressure on the ends of long feeders are advantages that far outweigh all the advantages of the three-wire machines. Also, if there are to be several units, it is cheaper to use two-wire generators and a balancer.

A. G. Rakestraw, Harrisburg, Pa.—Either system will answer under all the conditions imposed by three-wire distribution, and the selection therefore depends upon the cost and efficiency of operation. The three-wire generator will be somewhat cheaper than the two-wire generator and balancer, and has the advantage in requiring less floor space. On the other hand, the two-wire generator is the more efficient, and, in case of an unbalanced load, can take advantage of the full capacity, as is not the case with a three-wire generator. Furthermore, with a well-balanced system, the balancer set can be shut down for a time if necessary and the neutral wire will carry the unbalanced load. In general, the two-wire generator is considered the best practise.

V. L. Board, The Denver Gas and Electric Company, Denver, Colo.—It would depend to a considerable extent upon local conditions. The cost, probably, is the most important factor to be considered. For installations of the same capacity, the balance coils of the three-wire generator cost less than a balancer set, while the three-wire generator, with its slip rings, costs more than a two-wire generator. The balance coils, of course, do not require as much attention as a balancer set.

OVERHEAD AND UNDERGROUND LINES

11—21. What has been the experience of member companies regarding the uses of varnished cambric for insulating high-tension cables?

What voltage do you use it on?

What is the temperature of the air where it is used?

How many years have you had it in service?

Do you cover it with lead or with braid?

Have you ever had any trouble with varnished cambric cable?

How does it compare in durability with good rubber when exposed to the same conditions of load and external temperature for the same number of years?

O. H. Hutchings, The Dayton Lighting Company, Dayton, Ohio.—What voltage do you use? 2300 and 6600, 3-phase, 60-cycle ungrounded circuits.

What is the temperature of the air where it is used? Our station cables are exposed to a surrouning temperature of approximately 90 degrees of Fahrenheit.

How many years have you had it in service? Five.

Do you cover it with lead or with braid? Our station cables are simply covered with fire-proof braid. The underground cables, of course, are lead-covered.

Have you ever had any trouble with varnished cambric cable? No.

How does it compare in durability with good rubber when exposed to the same conditions of load and external temperature for the same number of years? As we have no rubber insulated cable installed, we cannot make this comparison, but will say, after investigating this subject carefully, we decided in favor of the varnished cambric installation, and have had no reason to regret our decision.

William R. Huntley, Assistant General Manager, Buffalo General Electric Company, Buffalo, N. Y.—We have never used varnished cambric cable. The reason for this has been on account of the increased price over rubber and paper cable.

A. S. Loizeaux, Electrical Engineer, Consolidated Gas, Electric Light and Power Company of Baltimore, Baltimore, Md.—We have had very litte experience with varnished cambric cable. One of our generators was supplied with varnished cambric three-conductor cable, and it was removed to use single conductor cable of larger capacity. We are now using single conductors with a combination insulation of rubber and varnished cambric and have had no trouble with the same. In some of the places where the cable is installed the summer temperature will probably reach 110 degrees Fahrenheit.

George W. Cato, General Superintendent, The Edison Illuminating Company of Detroit, Detroit, Mich.—We have a number of three-conductor varnished cambric lead-covered cables in use on 4600 volts, which have been in service about five years. Also two cables, each seven miles in length, on 23,000 volts, which have been in service about three years.

These cables are in underground conduits which attain a temperature of 90 to 95 degrees Fahrenheit during the summer.

We have had trouble on some of the 4600-volt cable due to overloading, and we find that the cambric will not stand up as well on overloads as paper insulation, as the dielectric strength falls quite rapidly with increasing temperature.

One of the 23,000-volt cables has broken down three times. One of these failures was due to the proximity of a steam pipe, the other two being of unknown origin.

While our experience with varnished cambric cables has not been entirely satisfactory, the fact should be considered that they were installed during the early stages of the development of this type of cable, and as numerous improvements in materials and methods of manufacture have since been made, better results are to be expected with varnished cambric cables of recent make.

We have no unsheathed cables in service, and from our experience with some short lengths of single conductor varnished cambric cable carrying 220 volts in wet conduits, would say that such cables would be unsatisfactory except in dry locations.

F. Uhlenhaut, Jr., Chief Engineer, The Allegheny County Light Company, Pittsburgh, Pa.—Our experience covers a period of five years and the varnished cambric has been eminently satisfactory. The working voltage is 11,500 volts. The aerial cables are exposed throughout the year and are placed on vibrating structures such as bridges, viaducts, etc., and are covered with a double spiral steel tape, over which is placed a double weatherproof braid. A lead cover would crystallize under the severe conditions.

We have had no breakdowns in the cambric cable itself, all of the trouble appearing in the joints, especially those that were made in cold weather.

Our experience with this style of cable, which I believe is the only aerial cable used not protected with a lead covering, has warranted its adoption as our standard construction.

Wallace S. Clark, Engineer, Wire and Cable Department, General Electric Company, Schenectady, N. Y.—Varnished cambric cable, to our knowledge, is used in long lengths on voltages up to and including 25,000 volts and in shorter lengths (station work) on voltages up to 60,000. We have records of 10,000 to 13,000 volt installations which have now been in successful operation, *i. e.*, without any trouble, for eight years.

Varnished cambric cable is used both lead jacketed and with braided finish, the same practise with regard to finish being followed on varnished cambric cable as would be on rubber insulated cable.

Our records show a smaller percentage of complaints on varnished cambric cable than on either paper or rubber cables, in proportion to the amount sold.

The comparative durability of first quality 30 per cent Para rubber insulation and varnished cambric insulation has not yet been determined, as under ordinary working conditions both are good for long periods of time.

John Harisberger, Superintendent, Seattle-Tacoma Power Company, Seattle, Wash.—This company has no varnished cambric for insulation on any of its cables, with the exception of the 50-000-volt 'busses in our transforming stations. This cambric was applied by our own men and has not been tested as to its dielectric strength since it was put in place; as far as visual inspection will determine, the cover seems to be all right. The temperature of the room where this is used will vary from 50 degrees Fahrenheit to 90 degrees Fahrenheit.

M. G. Kennedy, Superintendent, Syracuse Lighting Company, Syracuse, N. Y.—Here in Syracuse we are using varnished cambric cable quite generally for both high and low tension work. We consider it better than paper insulated cable, as we find that it can be installed with less liability of injury, and we prefer it to rubber insulation because of it having a greater overload capacity. We use cable having varnished cable insulation, and voltages from 220 up to 15,000 volts. Our high-tension and sub-station cables have this insulation and are covered with braid. Underground cables operating at voltages from 220 up to 2300 volts are lead-covered. The station and substation cables are exposed to an outside air temperature as high as 110 degrees Fahrenheit. We have been using this type of cable for something over three years, and we have not had any trouble with it.

Regarding its durability as compared with good rubber insulation, I do not think that we have used varnished cambric for a sufficiently long period to warrant an exact and definite statement.

G. L. Wiley, Manager Eastern Sales Department, Standard Underground Cable Company, New York.—Varnished cloth cables are in extensive use at the present time for all voltages up to 15,000, both in lead-covered form for underground use, and in braided use for interior wiring. This type of insulation has not yet come into very extensive use for ordinary building wiring, owing to lack of knowledge in this field as to its valuable qualities; but, on account of its advantages, it is destined soon to play an important part in this class of service, replacing rubber-covered wire, especially in the larger sizes.

Varnished cloth as an insulation for cables occupies a position intermediate between paper and rubber, and combines better than any type of insulation the relative advantages of each of these two. It does not so much depend on the integrity of a lead sheath as a protection against moisture or continuous service as does paper insulation, and it will stand a higher working temperature than will rubber insulation. As compared with a paper insulated underground cable, due to the lesser importance of guarding against absorption of moisture from the atmosphere in making joints, and likewise the lesser probability of injury due to breaking the insulation in making sharp bends, of two cables, one insulated with varnished cloth and the other insulated with paper, installed by the same gang and with the same care, and each capable of withstanding the same factory test, that with varnished cloth insulation will have the greater factor of safety.

Varnished cloth has the further advantage over both paper insulation and rubber insulation, in that it can safely withstand momentarily over-voltages or surges of a higher value than either of the other two.

L. L. Elden, Boston, Mass.—What has been the experience of member companies regarding the use of varnished cambric for insulating high-tension cables? What voltage do you use it on?

A. All voltages up to 15,000 volts.

Q. What is the temperature of the air where it is used?

A. Maximum temperature of 100 degrees Fahrenheit.

Q. How many years have you had it in service?

A. Nine years.

Q. Do you cover it with lead or with braid?

A. Small quantities of heavy single-conductor cables are covered with lead. The largest amount of varnished cambric cable in service is covered with flame-proof braid and is used with switchboard construction in generating and sub-stations.

Q. Have you ever had any trouble with varnished cambric cables?

A. No, except in a few cases the varnish compound used on the cambric has acted on the copper conductors sufficiently to damage the cable for certain uses.

Q. How does it compare in durability with good rubber when exposed to the same conditions of load and external temperature for the same number of years?

A. Varnished cambric cable of certain manufacture retained its flexibility and insulating property indefinitely when covered with braid or lead sheathing. A rubber insulation of good quality, where similarly protected, should be equally efficient, as regards life and maintenance, as varnished cable insulation.

E. W. Babcock, Superintendent Electrical Construction, Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.—

Q. What voltage do you use?

A. 6600, 2500 and 125 volts.

Q. What is the temperature of the air where it is used?

A. In summer as high as 120 degrees Fahrenheit.

Q. How many years have you had it in service?

A. Ten years.

Q. Do you cover it with lead or with braid?

A. With "flameproof" braid in dry places; with lead where there is a possibility of moisture.

Q. Have you ever had any trouble with varnished cambric cable?

A. Have never had a failure either in the joint or the original insulation.

Q. How does it compare in durability with good rubber when exposed to the same conditions of load and external temperature for the same number of years?

A. We have taken out for examination varnished cambric cable which had been in use for eight years. Its insulating qualities were unimpaired. It could, without injury, be bent to a much shorter radius than cable of high-grade rubber of the same age. While lacking exact data regarding the percentage of new Para in the rubber cables examined, our experience has led us to believe that equal insulation and life can be secured for less cost with varnished cambric than by specifying the best grade of rubber. Varnished cambric can be used immersed in oil (in switches, transformers, etc.) without injury. There is not the danger of the conductor being decentralized as in rubber. Greater loads can be carried without injury to insulation than with rubber. Varnished cambric cannot be applied successfully to wires of smaller diameter than No. 6 B. & S. For such wires a combination of rubber core and varnished cambric outside is used.

P. Junkersfeld, Assistant to Second Vice-President, Commonwealth Edison Company, Chicago, Ill.—Our experience is, with one exception, limited to varnished cambric cable inside of buildings, and even in that case to 9000 and lower voltages. This experience extending over various periods, with different installations, up to eight years, all of which has been very satisfactory.

The exception mentioned is for cable operated at 20,000 volts and in this we answer the sub-divisions of the question in order:

1. The highest regular service voltage that we have impressed on varnished cambric cable is 11,000 to ground for single conductor cable.

2. The temperature of the air surrounding this cable, which is mounted on insulators, never exceeds 100 degrees Fahrenheit.

3. This cable has been in service for one year.

4. The covering is of braid.

5. Our trouble with varnished cambric cable has been very slight. We have used it for field leads of large units where the potential runs up very high on discharge at times. We have also used it for test leads where there is likely to be a voltage of 40,000 to ground, but in these particular test leads the cable is of composite structure, having inner core of rubber.

6. Our experience with rubber cable which is partly exposed leads us to believe that cambric cable will prove much more durable.

O. M. Rau, Superintendent Electric Lighting, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—

1. We use varnished cambric cables for 6600 and 13,200 volt station wiring and for 13,200 volt and 2300 volt underground lead-covered cables.

2. The temperature of the air in which the cable is used varies from a low figure in the winter up to as high as 110 degrees Fahrenheit in summer.

3. Some of our cambric cable has been in service five years.

4. We use lead cable in ducts and braided cable in open station wiring or where the effects of the lead induce static difficulties. We have had braided cable in underground ducts where more or less moisture was present in service for periods of three and four years before any trouble developed.

5. We have never had any trouble with lead-covered cambric cable, but have had trouble with braided cambric cable run in ducts where some moisture was present and where the bends were of rather short radius.

6. We consider varnished cambric insulation to be much superior to rubber and utilize it entirely where the conditions are severe, either as to temperature or moisture. In one locality where it was impossible to maintain lead cable we installed sufficiently insulated rubber cable that only lasted approximately six months. This we replaced by varnished cambric cable, and we have as much as four years' service from them. We are now using cambric cables as a substitute to rubber cables entirely for our underground and important transmission-line work.

Allegheny County Light Company Section, Pittsburgh, Pa.—We have been using varnished cambric, lead-covered cables for the past four or five years on 2200 and 11,000 volt lines, and find them very satisfactory. The temperature in which they operate ranges from 50 to 100 degrees Fahrenheit. They do not seem to be as reliable under high-temperature conditions as the paper-insulated cables working under the same conditions.

12—46. (a) Have member companies experienced trouble from the wireless telegraph stations affecting their lighting lines?

(b) If so, what protective devices are used and what are your requirements before you will accept a wireless station on your lines?

(c) Have you found cases where these wireless stations were installed on your lines without your knowledge of same; and if so, what action have you taken?

(d) Do you require separate service, separate transformer, and separate meter for each installation? If so, do you bill the consumer at the regular lighting rate? Do you make any charge for connection?

(Also answered in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—The boys of Los Angeles have several hundred small wireless stations and in individual cases we experience some temporary trouble. When we receive complaints of the lights jumping in a neighborhood, we know that there is a wireless working there. Our inspector easily locates the station and then it becomes a matter of agreement. If the boy will keep off after dark he is allowed to use the current without charge, except for what is consumed on the meter connected with the residence lighting. If he wants to work at night he is compelled to purchase a transformer, from which we run a separate service free of charge, except the regular minimum charge of $1 a month, the consumption being billed at the regular lighting schedule. This, of course,

is not profitable, but we have a very kindly feeling toward boys who wish to monkey with electrical devices, and try to lend them all the encouragement which can reasonably be expected.

W. K. Brown, Foreman Meter Department, Malden Electric Company, Malden, Mass.—In the past two years, we have had numerous complaints about lighting service due to wireless outfits. Our requirements are as follows:

A condenser of suitable capacity and design must be provided, to be connected in multiple with the service wires immediately adjacent to and on load side of meter. This condenser must be bridged to a one-sixteenth-inch spark gap adjusted approximately for 1000 volts and so constructed as to permit a separate plate in centre of condenser to be connected to the ground.

In place of condenser as stated, two condensers may be used and ground connection made to wire joining the two condensers, using the spark gap.

No other ground connections are permitted in connection with the apparatus, except the ground connection from the secondary side of the oscillation transformers to which the antenna is connected. This ground wire must be of No. 4 B. & S. gauge copper.

The switch employed to join the aerial and the ground shall not be smaller than 100 ampere capacity.

All wiring to meet standard requirements. Cases have been found where wireless outfits have been installed, upon making an inspection of service complaints. The attention of the operators of these wireless outfits is called to the interruption of the service, condition of their wiring, etc. Instructions are given to properly equip apparatus, and are generally complied with. The local wire inspector is also notified.

We install a separate transformer for large installations and all wireless apparatus is metered and billed at the regular rate.

We make it a practise, whenever possible, to locate transformer supplying secondary street mains so that the service having the wireless outfit feeds direct from this transformer.

We make a special charge to connect wireless outfits if no lamps are to be installed.

12—47. If all the station output of single-phase, 2300-volt, 60-cycle current for incandescent lighting is metered at the station and all the customers are on meters, in a town of 5000, what proportion exists in actual practise, between the total consumption as indicated by the customers' meters and the total output of the station as indicated by the station meter? In general, what per cent of the loss is chargeable to line, transformers, meters—what else?

(Other replies in May BULLETIN.)

Alex Dow, The Edison Illuminating Company of Detroit, Detroit, Mich.—I take it that the inquirer has in mind the town where the business has grown along the lines of least resistance, with a lot of small customers, and that meters, transformers and circuits are as they happened once upon a time, and not at all according to the latest rules for efficiency. I assume also that the single-phase circuits carry practically no power and have little daytime lighting, although the lines are kept alive 24 hours a day.

In such a town I would expect the sum of the readings of customers' meters to be about 45 per cent less than the reading of the station meters. The distribution of the losses would be about as follows: Feeders, mains, secondaries and house connections, 16 per cent; line transformers, 12 per cent; meter shunts, 2 per cent; meter slip (or failure to register), 15 per cent.

Of course, such loss is scandalous, but it is exactly what I expect to find. If the loss is less, it is because of proper proportioning of transformers to load, intelligent use of secondary main, and attention given to cutomers' meters. These will reduce the total loss to 20 to 25 per cent, the saving being about equal on transformers and on meter slip, with a small saving in lines.

Once in a while I get a report from such a station of efficiency, station meter to customers' meters, of 85 per cent or better. In such a case I invariably ask for a verification of connections and calibration of station meters. It is a shame to be so distrustful—but——

J. L. Buchanan, Transformer Specialist, General Electric Company, Chicago, Ill.—The writer has investigated a number of cases and has found that for a town of 5,000, a loss of from 25 to 30 per cent represents average conditions.

In a city of 100,000, data showed this loss to vary from 20 to 25 per cent, and the distribution system in this particular case was very carefully designed.

12—48. We operate two 11,000-volt transmission lines, each approximately fifteen miles long. Near the end of each line a tap-off is made to supply large customers with power. Will member companies please advise what method they take to make high potential line tests on their transmission lines; also how they locate grounds or open circuits on such transmission lines?

(Other replies in May BULLETIN.)

P. B. Juhnke, Chief Load Dispatcher, Commonwealth Edison Company, Chicago, Ill.—Our lines are ordinarily tested only after the completion of work or repairs which require the killing of lines and the shutting down of the load if no reserve lines for it are available. This is done only after a consultation with the customer, and the time selected is such as will cause the least inconvenience to him.

The method of procedure in the subsequent test is as follows:

When the work is reported done, ground connectors and fuses are removed from both ends. A low-tension voltmeter test is made to determine whether the line is clear from ground. If so, a low test pressure is put on by means of a special test set and brought up to double normal working potential and kept there for one minute, after which time the line is gotten ready for service. As nearly all our lines are underground, faults, in the greater number of cases, are quite reliably located by means of the familiar Murry loop test. It is necessary, however, for this test to be successful, to have one of the three conductors continuous and free from ground; likewise the grounded conductor must be continuous.

If the ground is on the tap, it will show up at the point where the tap is made. If the tap is of considerable length, the fault may be located by looping the ends of the tap together and repeating the loop test from the generating station. If all three phases are burned open or grounded, recourse is had to the interrupter method described in a paper read by Mr. Durgin at the St. Louis Convention. If this method proves unreliable, the familiar "cut and try" method is resorted to, which consists in dividing the faulty portion of the line into halves, until the fault is located between adjacent manholes.

In the case of an overhead line the simplest and quickest way is to have the line patrolled by competent trouble men who can repair the trouble as soon as they find it, tests to determine its location being little better than a waste of time.

M. G. Kennedy, Superintendent, Syracuse Lighting Company, Syracuse, N. Y.—We have here in Syracuse about 25 miles of 11,000-volt lines, but we have not thought it necessary to subject them to high-potential tests nor have we made use of any special device or method to locate grounds or open circuits on them.

In operating the lines, it is our practise to inspect them once a week in order to locate any structural weaknesses or defects in our own work or of other companies or individuals adjacent to our lines. We do this because most of our lines are run on city streets, public highways and railroad rights of way. If the inspector reports conditions that might possibly lead to trouble, we take steps at once to prevent it. After every storm the lightning arresters on the sub-stations and transformer houses are inspected and the necessary cleaning and repairs made if such are found necessary.

For the convenience of the inspector and repair men, we have installed along the line at frequent intervals weather-proof cans which contain supply material, such as insulators, tie wires, sleeves, etc., in order to facilitate repair work.

In constructing the lines, we installed sectionalizing switches on all branch lines where they leave the trunk line, and have split the trunk line with

sectionalizing switches at convenient points. We expect this arrangement will allow us to give service to consumers connected to lines not in trouble by cutting out the line so affected. Grounds and open circuits will, of course, make themselves known at the switching stations, and it is our practise, should a breaker open on any of the lines, to make two attempts to close the switch. If it cannot be closed, repair men are sent at once over the line or to the point of trouble if we happen to be advised of its location by a consumer or other party.

It has been our good fortune to have practically no trouble on any of our 11,000-volt lines, resulting from defects in our own lines or apparatus or that of our consumers, and I am of the opinion that ground or open circuits on 11,000-volt work can be reduced to a minimum, and that troubles generally will be no more frequent than on the 2300-volt lines if the construction is done well and the selection of the material used in the lines is properly made.

P. M. Downing, Engineer, Pacific Gas and Electric Company, San Francisco, Cal.—It is the practise of the Pacific Gas and Electric Company to test all transmission lines, regardless of lengths and voltage, by throwing full working voltage directly on the line without attempting in any way to bring it up gradually. Troubles, such as grounds and open circuits, are located by sectionalizing and testing the different sections until the defective section is found. Men are then sent out to patrol the section in trouble. Attempts to locate the fault by resistance or other measurements have generally proven unreliable and for this reason have been abandoned entirely, and we now make tests as outlined above.

12—49. Do member companies find it practicable to have linemen's hatchets equipped with a leather thong or rope to slip over lineman's wrist while he is using hatchet at work on pole above ground, in order to prevent injury to persons on ground should hatchet slip from his hand?

(Also answered in May BULLETIN.)

J. W. Lafferty, Sunperintendent of Distribution, Edison Electric Illuminating Company of Brooklyn.—This company does not require thongs to be attached to the handles of hatchets used by the linemen, but in the majority of cases the lineman does this himself. There is no objection to the practise, the main advantage being that in case of trouble, where both hands are required, the lineman can let go of same quickly and there is no danger to anyone under the pole. It is also handy to have a thong attached for hanging same to the belt or some part of the pole, when not in use.

12—50. What methods do member companies use to supply combined light and power from a three-phase circuit, where the use for lighting is above the limitation for a single-phase circuit?

R. M. Stevenson, Brooklyn, N. Y.—The lighting and small single-phase power loads should be carefully divided between the phases and each phase equipped with an automatic feeder regulator.

Paul F. Williams, Assistant Engineer of Distribution, Commonwealth Edison Company, Chicago, Ill.—We use what is commonly known as the four-wire three-phase system, that is, the generator windings on the machines are star connected. The neutral, or fourth wire, is brought out from the common point of the three windings. Ordinarily any lighting installation is connected across this neutral and one-phase wire. Wherever the installation is of such size as to overload the single-phase, another transformer is connected across the neutral and one of the other phases. If that particular lighting installation exceeds the capacity of the two phases, a third transformer is installed between the remaining phase and neutral.

Three-phase power is connected to the same circuit by connecting three transformers by the ordinary three-phase connection.

12—51. What method of lightning protection has been adopted by members who are now employing 11,000-volt to 110-volt distributing transformers on 11,000-volt transmission lines? What success have member companies had with this method of distribution? Our line runs through a level country, but

we are subjected to severe lightning storms, the path of these storms being diagonally across our line through practically its entire length of twenty-five miles. The object of these transformers would be to supply farmers and one or two small villages along this line.

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—In our practise we have no reductions from 11,000 to 110 volts in one conversion, as I do not believe that the Underwriters' rules will permit this step through one transformer only. Where we are stepping down from 13,000 to 2300 volts we have placed the transformers outdoors, without shelter, and have installed aluminum cell arresters underneath them, in a wooden covered structure. This practise has worked satisfactorily so far. Such construction would probably prove too expensive for individual installations of small capacity and it might be advisable to omit lightning protection at such points, provided the main line was well protected.

I would suggest that your querist take this up with the lightning engineers of the manufacturing companies.

Gordon Weaver, New Business Department, Kansas City Electric Light Company, Kansas City, Mo.—This company has a distributing system for three-phase power of 6600 volts, and in sub-stations have aluminum cell type arresters installed as a protection to the distributing transformers, and finds them very satisfactory. The writer knows of a large distributing system where 17,000 volts are employed for distribution that had multiplex arresters installed. These arresters took fairly good care of induced strokes, *i. e.*, strokes that ran parallel to the line, but were practically useless when a direct stroke hit the line. Aluminum arresters have recently been installed and lightning troubles have been practically eliminated.

A. D. Quackenbush, Assistant Superintendent Mobile Electric Company, Mobile, Ala.—We have an 11,000-volt line which has been in continuous operation for three years, with no trouble whatsoever. At the power station and at the sub-station we have installed lightning arresters of the multiplex type. We are now building an additional five-mile extension to this line. The sub-station at the far end of this line is to be entirely open, being built upon a platform in the open country. At this sub-station we are to install a multiplex type of lightning arrester in weatherproof boxes, directly upon the pole, and we do not anticipate any trouble whatsoever.

Allegheny County Light Company Section, Pittsburgh, Pa.—The most economical method for lightning protection under these conditions is to employ a horn spark-gap and choke-coil of the open-air type for pole-top mounting. Each transformer should also be equipped with an air-brake switch and horn-gap fuse or high-tension expulsion fuses on the high-tension side. As a further safeguard, the neutral point of the secondary winding should be thoroughly grounded.

12—52. Do any member companies give their linemen's rubber gloves any test before issuing them for service? Do any buy linemen's rubber gloves under any specification, and if so, would like to know what points are covered?

T. H. Yawger, Rochester Railway and Light Company, Rochester, N. Y. —We furnish each and every one of our linemen with the very best quality of rubber gloves that can be procured in the market, and issue very strict orders that they use these gloves when the occasion requires. The linemen are inclined to neglect the precaution of using gloves, and unless we follow up and see that the orders are carried out, their use is neglected.

We make a test for insulating properties of each lot of gloves we purchase.

J. W. Lafferty, Superintendent of Distribution, Edison Electric Illuminating Company of Brooklyn.—The rubber gloves used by this company are given a breakdown test of 5000 volts, and also an air-pressure test, before being issued for service. They are not purchased under specification, but are guaranteed against breakdown at 5000 volts.

J. C. Gapen, North Shore Electric Company, Chicago, Ill.—The North Shore Electric Company is operating a three-phase, four-wire 2300/400-volt system.

We work practically all our lines alive, and furnish all our linemen with rubber gloves. These gloves are tested before being given out to the linemen, at a voltage of 4500 volts alternating current. Any gloves which do not stand this test are returned to the manufacturers.

A. D. Quackenbush, Assistant Superintendent, Mobile Electric Company, Mobile, Ala.—We buy what is known as a 5000-volt rubber glove. We seldom make tests on the new gloves, but, periodically, gloves are called in and filled with water, and one electrode of a transformer connected for 4400 volts is connected inside, and the glove is lowered into a tub of water which has the other transformer terminal connected. By this means we get a very good test whether the gloves are in good or bad condition.

B. E. Strohm, with the Commonwealth Edison Company, Chicago, Ill. Present residence, Covina, Cal.—Rubber gloves are all given tests, before issuing them for service, by our own testing department, by being submitted to three or four times higher voltage than the normal working pressure of lines on which they are to be used.

18—24. What rules are member companies pursuing in regard to bending of high-tension lead-covered cables, and approximately what proportion of cable faults occur at bend?

T. H. Yawger, Rochester Railway and Light Company, Rochester, N. Y. —Our rules regarding the bending of high-tension lead-covered cables are dependent upon and vary with the size and insulation of the cables; in all cases making the bend of the longest possible radius consistent with the size and condition of the manhole in which they are to be placed. No hard and fast rules, however, can be laid down, as manhole conditions are so varied.

Our proportion of cable faults which occur at bends is not more than 2 per cent of total cable trouble.

B. E. Strohm, with the Commonwealth Edison Company, Chicago, Ill. Present residence, Covina, Cal.—A safe rule for bending paper and lead-insulated cable is to have a radius of not less than ten times the diameter of the cable, the curve to be a true arc of a circle. My experience has been that no more burn-outs occur at the bends when the above rule is applied than in the straight cable. Practically all burn-outs occurring at bends are caused by mechanical injury or at a point in the bend where the radius is less than it should be, thus making an untrue arc of a circle.

Allegheny County Light Company Section, Pittsburgh, Pa.—Bends in high-tension cables should not be made with a radius of less than seven times diameter of the cable to be bent. In cold weather, care should be exercised in bending cable, and when the temperature is at or below freezing point, the cable should be warmed before bending. This applies principally to paper insulated cable; rubber insulated cable may be bent at any time. In some small junction boxes, it is necessary to make bends of a somewhat smaller radius than that given above, on account of lack of room, but this should be avoided when possible. Our experience has been that about 3.5 per cent of all trouble in lead-covered cable occurs in the bends.

18—25. Have member companies had experience with the scheme by which arcing grounds in cable or overhead lines are eliminated by means of single-pole automatic switches connecting phase in trouble to ground by means of relay in case arcing ground is started, thus eliminating the effect of the arc in either burning cable and causing dead short, or breaking down insulators in case of overhead lines?

Charles I. Burkholder, General Manager, Southern Power Company, Charlotte, N. C.—We have on our system one of the arcing ground suppressors to which your member refers. This was put into service last fall, and it worked satisfactorily in cases where we established the grounds ourselves.

Our bad season in spill-overs has just now started, but we have never had a ground on the line on which this device is connected since it was put into service. I expect, however, within two or three weeks, as the season advances, that we will have ample information as to its practicability.

V. E. Goodwin, Power and Mining Department, General Electric Company, Schenectady, N. Y.—The device referred to is the arcing ground suppressor, which we have had under development for the past year.

The object of the arcing ground suppressor is to prevent the serious effects of oscillations which result from arcing grounds by immediately dead-grounding the line on which an arc to ground starts. The device consists of three single pole, automatic oil switches, each connected between a line and ground and controlled by either an electro-magnetic or electro-static relay. The oil switches are interlocked so that only one switch can be closed at a time in order to avoid short circuits.

Up to the present time we have had but limited experience with this device, although it looks very promising. A very thorough series of tests were made on one of these devices connected to the 33,000-volt system of the Schenectady Power Company. Later a 44,000-volt equipment was installed on the lines of the Southern Power Company and oscillographic tests made to determine its effectiveness. Recently a 13,200-volt equipment has been installed on the underground system of the Public Service Corporation of New Jersey. Tests are now being made on a 60,000-volt equipment on the Toronto Power Company.

For more detailed description of this device I would refer your questioner to papers presented before the American Institute at the Pittsfield-Schenectady Mid-Year Convention of the A. I. E. E., February, 1911, by Messrs. Creighton, Burkholder and Marvin.

TRANSFORMERS, STORAGE BATTERIES, ETC.

14—7. Have any member companies had any experience with the Edison battery for vehicle work? Would certainly appreciate any information we can get on this subject.

(Also answered in April BULLETIN.)

A. G. Rakestraw, Harrisburg, Pa.—Our experience with the Edison storage battery has only covered a period of a few months, during which time we have tried out our Lansden electric truck equipped with these batteries. As far as we are able to ascertain, we believe the battery to be all that the makers claim for it.

14—8. Have any of the member companies purchased Gould storage batteries? If so, what capacity, and are they for peak or stand-by service?

C. H. Bishop, Superintendent, Valley Traction Company, Lemoyne, Pa.—This company installed in 1906 a Gould storage battery of 720 ampere rated capacity, including booster and switchboard. This battery is used on our railroad to handle the peaks.

G. A. Montgomery, General Superintendent, Montgomery Light and Water Power Company, Montgomery, Ala.—In the beginning of 1906 we purchased from the Gould Storage Battery Company a battery having a capacity of 240 amperes per hour to be used on our street railway system here. This battery floats on the line continuously, charging during periods of light load, and discharging during the peaks. These peaks come at intervals of about 15 minutes, and we have found the battery to be of great benefit to us in taking care of this class of business.

E. L. Franklin, Superintendent Electrical Department, Easton Gas and Electric Company, Easton, Pa.—In February, 1902, we installed for regulating service in connection with street railway load, a Gould battery consisting of 255 eleven-plate lead-lined tanks, rated at 400 amperes on the hour rating.

In 1904 it was found that this battery did not have sufficient capacity to take care of the widely fluctuating demand, and a battery of the same number of cells containing seventeen plates in lead-lined tanks, rated at 640 amperes on the hour rating, was installed. Both of these batteries were then used to keep the load on our railway machines constant, part of the time on two independent boosters and later paralleled with one booster. By making this installation, we were able to shut down an 800 horse-power steam engine which

was operating in connection with our water-power plant to take care of the fluctuations in the street railway load.

In 1903 we had a disastrous flood which completely submerged the smaller battery. After the flood this battery had to be taken apart to get rid of the mud and refuse deposited by the water, and on account of the limited time available, the battery did not receive as careful treatment as it should, which caused slight troubles immediately after being put in service.

In 1905 this battery was cut up into sections and used on Edison three-wire system for stand-by service.

In 1908 this battery was moved to a sub-station and again used in connection with a regulating booster for trolley service. This makes the life of the smaller battery nine years and that of the larger battery seven years.

During the peak months of the year, when our day and night loads overlap, plates, and during the present year we will have to put in probably 300 or 400 more.

These batteries have given us very little trouble. We find it necessary to clean about once in three years. This period varies, depending on the care given the battery. We have had a number of buckled plates from various causes, but these plates have been cut out, straightened on a wooden block and burned back into the battery again, and continue to give service.

We are not able to give any figures as to the efficiency or capacity of these batteries, because we are not able, without considerable expense, to arrive at the input and output of the battery; however, the efficiency of the sub-station, including battery losses, using motor generator sets, averages about 82 per cent. This is over all efficiency from alternating current input to direct-current output.

During the peak months of the year when our day and night loads overlap, we use these batteries for peak service by allowing them to show a net discharge during the hours of this peak.

We have had some troubles from leaks, but believe that with double insulation this trouble can be remedied.

Our battery rooms are remarkably free from acid fumes, which adds greatly to the comfort and efficiency of the man who has to take care of the battery.

From our experience, it seems easier to take care of a battery which is being worked up to its capacity than one which is doing less work.

Momentary loads of two or three times the hourly rating have caused no trouble whatever.

J. W. Brennan, Purchasing Agent, The Edison Illuminating Company of Detroit, Mich.—We have only four cells of Gould battery in one of our stand-by batteries, but have not had enough experience with these cells to make any report. We also have several small Plante type plate batteries for auxiliary lighting in our sub-stations, and the service they are giving us is quite as good as we can expect from any battery of this type plate.

A. H. Purdy, General Superintendent, The Topeka Edison Company, Topeka, Kan.—We have the Gould storage battery. Battery was installed for regulating and peak load service.

The installation consists of 280 elements, type S-617, each having a capacity of 640 amperes for one hour and a booster set which controls the operation of the battery so that the generator load does not vary more than 2 per cent. Battery was installed September, 1905. We renewed approximately 5 per cent of the positive plates in 1909, 5 per cent in 1910, 34 per cent in 1911, and will renew the balance, or 56 per cent, in the year 1912, making complete renewals of the positive plates in the first six and one-half years in the operation of the battery.

Negative plates are in good condition, and from appearances at this time, they will last indefinitely.

15—56. Kindly explain as to the method of checking the ratio of current transformers on high voltage in central stations. Kindly give data, etc.

(Other replies in May BULLETIN.)

William A. Durgin, Assistant Chief Testing Engineer, Commonwealth Edison Company, Chicago, Ill.—None of the methods at present in use for

checking ratios of current transformers are applicable while the transformers are connected in the high-voltage circuit, even though the circuit can be killed for test. In consequence, transformers are checked in the laboratory before installation. Detail description of laboratory test methods may be found in the National Bureau of Standards Bulletin No. 130; in the paper by L. T. Robinson, published in the American Institute of Electrical Engineers Proceedings for 1909, page 981; in the discussion of this paper in same volume of the Proceedings, page 1356; in a paper by Mesrs. Sharp and Crawford, published in the American Institute of Electrical Engineers Proceedings for 1910, page 1207, and in pamphlets issued by the Leeds & Northrup Company, which contain descriptions of their "comparator apparatus."

S. R. Keyes, The Edison Electric Illuminating Company of Boston, Mass.—The above question appears to be a trifle ambiguous, as it is not quite clear as to whether information is desired regarding the determination of the ratio of transformers which are used on high voltage in stations, or whether it is desired to find a method of checking these transformers while they are alive at their rated voltage on commercial load.

The checking of transformers on commercial load is not considered to be very satisfactory, as, owing to the fluctuations of the current, the results which are obtained are likely to be unreliable. Checks of this sort are only made when it is desired to locate trouble of some sort, and where the results desired need to be put approximate.

In practise, when it is desired to obtain ratio measurements on current transformers while they are in place at the stations, the transformer is disconnected from the circuit, and an artificial load applied by means of a portable low-voltage transformer or "booster."

For the measurement of current in either of the above cases, use is made of a special set of current transformers whose ratio at various loads has been carefully determined. One of these so-called standard transformers is put in series with the transformer under test. If the test is to be made under "live" conditions, this standard can be cut into circuit either by means of a test cell or by connecting it across one of the knife-blade switches at a time when the circuit is out of service.

These standards consist of General Electric, Type D, current transformers, which are built into hardwood carrying cases for convenience and protection during transportation. The primary terminals of the transformer project through the ends of the box, and are fitted with large wing nuts to facilitate the attaching of heavy cables. The secondary terminals, which are made of flexible wire, are about six feet long and emerge through bushings in the top of the case near a carrying handle. Extension leads, 20 or 30 feet long, are also employed when it is desired to locate the secondary instruments at some distance from the bus work.

About 28 of these transformers are provided for use in the various testing work of this company. They range in capacity from seven and one-half amperes to 1000 amperes, and are provided in pairs, so they may be used with indicating wattmeters in making three-phase measurements. General Electric iron-clad type instruments are used with these transformers when it is desired to get the most accurate measurements.

Facilities have been provided in the company's laboratory for checking the ratio of these standard transformers. For this purpose use is made of two Siemens & Halske "precision" current transformers and a "precision" ammeter. These "precision" transformers are each double wound and together cover a range from 100 to 1200 amperes. The "precision" ammeter is constructed on the dynamometer principle, and therefore may be accurately calibrated on direct current. This set has been calibrated by the Bureau of Standards and curves of the ratio of transformation and phase angle obtained.

Kelvin ampere balances are used for measuring currents from 100 amperes downward, and the Leeds & Northrup mercury ammeter is being experimented with for measuring currents from 500 to 1200 amperes.

15—57. In a transformer station with two step-down transformer banks, one 1200 kilowatts capacity and one 400 kilowatts capacity, Westinghouse oil-cooled transformers, connected in parallel on 6600-volt, three-phase, 60-cycle

system, using Scott connection, transforming to two-phase, 2200-volt, four-wire:

When banks are tied in together either on 6600-volt end or 2200-volt end, at times we get dips of from 2 to 15 volts on lighting system.

What causes these dips, and can same be remedied?

R. M. Stevenson, Brooklyn, N. Y.—This is probably caused by a surge due to the switch going in at a certain point on the wave. It may be avoided by having a reactance in circuit at the time the circuit is closed, or by gradually raising the voltage on the transformers with a separate generator. These measures are hardly worth the trouble they entail.

15—58. What experience have member companies had with three-phase transformers? Do the advantages of space, economy and cost more than counterbalance the disadvantage of a complete shut-down in case of trouble?

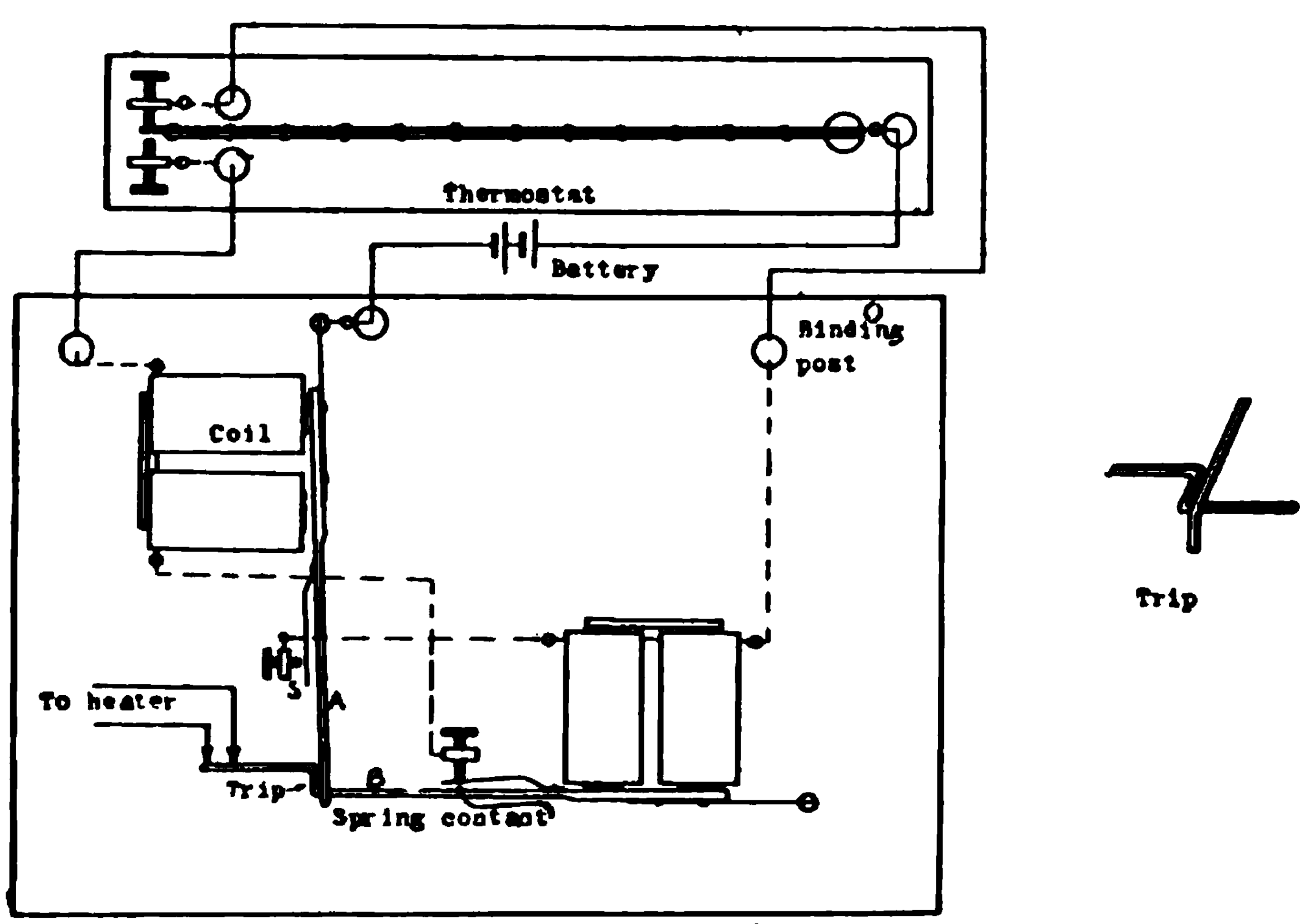
H. B. Gear, Engineer of Distribution, Commonwealth Edison Company, Chicago, Ill.—This company has in use a number of three-phase transformers in its sub-station equipment. We have not used them for ordinary line transformer purposes on poles or in customer's premises.

In sub-stations the advantage of space and first cost considerably overbalances the disadvantage of a complete shutdown in case of trouble, and therefore they have been made standard. In line transformers there is practically no economy in first cost, and the saving in space is of very little value.

The principal objection to their use in a system where the lighting is carried single-phase, is that a separate stock of power transformers must be carried in order to give prompt service, whereas with single-phase units the same stock will do for both light and power.

18—6. Wanted:—Information in regard to electric heating devices for incubators.

Lloyd Garrison, Engineer, Utah Light and Railway Company, Ogden, Utah.—The enclosed sketch shows diagrammatically the arrangement of an automatic heat regulator for use with incubators. This is designed for use with dry batteries and is so arranged as to cut off the current except at the instant of



switching. The heating is done from the ordinary lighting circuit and very good results are obtained with lamps.

The thermostat is constructed of strips of hard rubber and sheet iron riveted together and fastened rigidly at one end to a fibre or rubber base. The free end, as contraction or expansion takes place, oscillates between adjust-

able contacts, thus operating the regulator. The regulator is easily made of two electric bells with their clapper bars bent to form the trip as shown. The object of the trip is to lock the clappers in position after the magnets have acted. As soon as the circuit is closed by the thermostat and the magnet acts, the spring contacts break the battery circuit as it then exists and prepare it for the next action, thus throwing the battery out except at the instant of action.

ELECTRIC POWER—MOTORS

19—49. Would appreciate any information obtainable on the electric drive for rock-crushing plants, particularly as to the current consumption per cubic yard, and the average load factor for this class of work?

(Also answered in April BULLETIN.)

H. O. Stewart, Rochester Railway and Light Company, Rochester, N. Y.—The following information applies to stone-crushing plants with a maximum capacity of 200 yards per eight-hour day. The power consumption includes that used for elevating the material from the crusher to the storage bins.

Average monthly power consumption (eight months per year), 1400 kilowatt hours.

Average maximum demand, 20 kilowatts.

Average kilowatt-hour consumption per cubic yard of limestone crushed, 1.3 kilowatt-hours.

19—50. Have member companies been successful in securing power contracts for the complete operation of (a) breweries, (b) laundries?
If so, under what conditions were the contracts secured?

(Other replies in April BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—This company has been entirely successful in securing contracts with laundries and breweries. The breweries are given a rate under two cents per kilowatt-hour and use from 10,000 to 15,000 kilowatt-hours a month, they guaranteeing a liberal minimum which they always exceed, so it does not become operative. Laundries are given their choice of two rates; a three-cent rate with a monthly minimum of $25, or a two and one-half cent rate, with a monthly minimum of $50. Practically all the laundries and breweries in this city patronize one or the other of the electric companies. Laundry irons are allowed on the power circuits. The rates for lighting in this city are fixed by ordinance and all consumers are charged the same, consequently the special rates made to laundries and breweries only relate to power service.

19—51. Under what load-factor do the best hydro-electric plants operate?

(Other replies in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—The combined load-factor of our seven hydro-electric plants for the year 1910 averaged 69 per cent, beginning with 61 per cent in January, 1910, and finishing with 73 per cent in December of the same year. We have every reason to suppose that it will reach 80 per cent during the present year. We use our steam plants to take up the variation.

David B. Rushmore, General Electric Company, Schenectady, N. Y.—The load-factor of hydro-electric plants is something for which no one figure can be given. Hydro-electric plants are now generally parts of systems on which steam plants are also connected. The use of power varies greatly in different parts of the country. The power may be used for lighting, railway or mill work, electrolytic or electric furnace work, and the load-factor necessarily varies with the condition of service. Some hydro-electric plants feeding largely industrial power systems have a load-factor of approximately 50 per cent over the 24 hours. This is the ratio of the average load to the maximum load for a 24-hour period. Hydro-electric plants may be found with the load-factor as low as 20 and as high as 75, depending on the use of the power, so that it is impossible to give a definite figure.

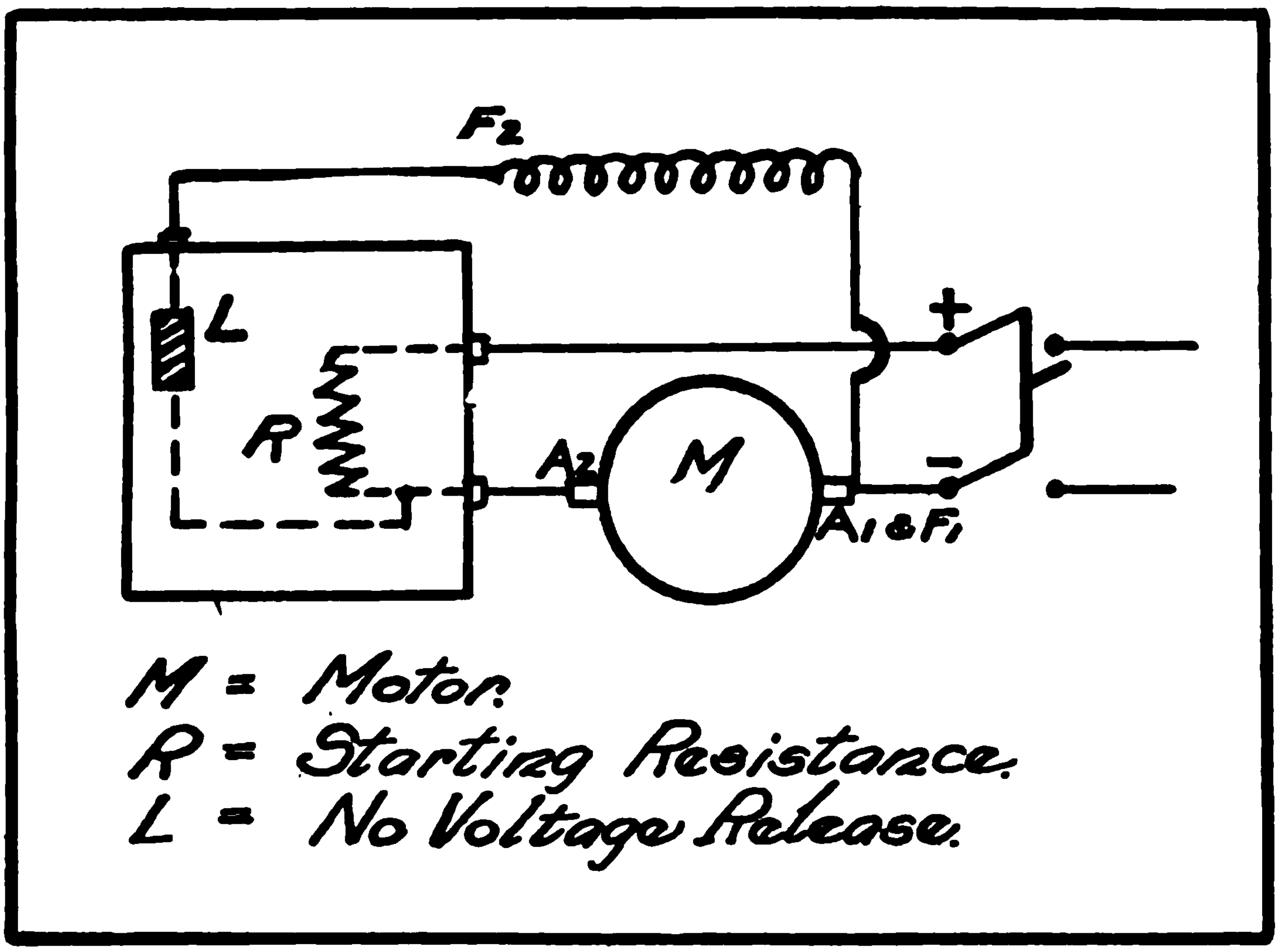
19—52. What requirements do member companies ask in connection with the installation of elevators, cranes and hoists operated by alternating current motors?

(Other replies in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—This company is urging the use of the three-phase motor for all such purposes, and at present is lending particular encouragement to the installation of elevators of this character, hoping that sooner or later they will displace the 500-volt direct-current elevators which are commonly operated in this city.

19—53. Can any member suggest a method of locating the trouble in the following motor installation?

A three horse-power shunt wound, direct-current motor was connected to the line through an Allan-Brady starting rheostat, as per diagram. When the switch was thrown in and the starting arm moved slowly to cut out armature resistance, the motor refused to start. By giving an energetic pull on the belt at the same time the motor started, but extreme sparking occurred on the commutator. As soon as the starting arm reached its maximum travel, thus cutting out all external resistance, the sparking ceased, and the motor operated under normal conditions. Excessive heating also occurred in the external resistance during period of starting.



H. H. Lyon, The Cataract Power and Conduit Company, Buffalo, N. Y.—The connections to the starting resistance, as shown in the diagram, should be reversed. When starting with connections as shown, the voltage across the field is the line voltage less the drop in voltage across the starting resistance. This causes a weak field, small starting torque and excessive armature current. The motor would run all right when all the starting resistance was cut out, because the line voltage would then be across the field.

William J. Hazard, Professor of Electrical Engineering, Colorado School of Mines, Golden, Colo.—The troubles are caused by a weak field, and will be removed by interchanging the line and armature terminals where they connect to the starting box, thus giving the field the full line voltage at all times.

To illustrate what happens with the connections as shown, assume that the motor is for 110 volts and that the field has a resistance of 75 ohms and the armature .5 ohm. Then the starting resistance, R, may be about 3.25

ohms. When the circuit is first closed through the resistance, there will be about 29 amperes through the armature and less than .2 ampere through the field. The voltage drop across the resistance will be about 95.5 and only 14.5 volts will be applied to the field instead of 110. This results in a very weak field, which does not give sufficient starting torque, even with the excessive armature current which will flow when some of the starting resistance is cut out. It is this heavy armature current applied for a comparatively long time, because of the slow starting, that causes the overheating of the resistance. The large armature current distorts the weak field and causes the poor commutation and the sparking.

John Richmond, The American Laundry Machinery Company, Rochester, N. Y.—Covering a shunt-wound, direct-current motor in series with an Allen & Bradley compression starter:—

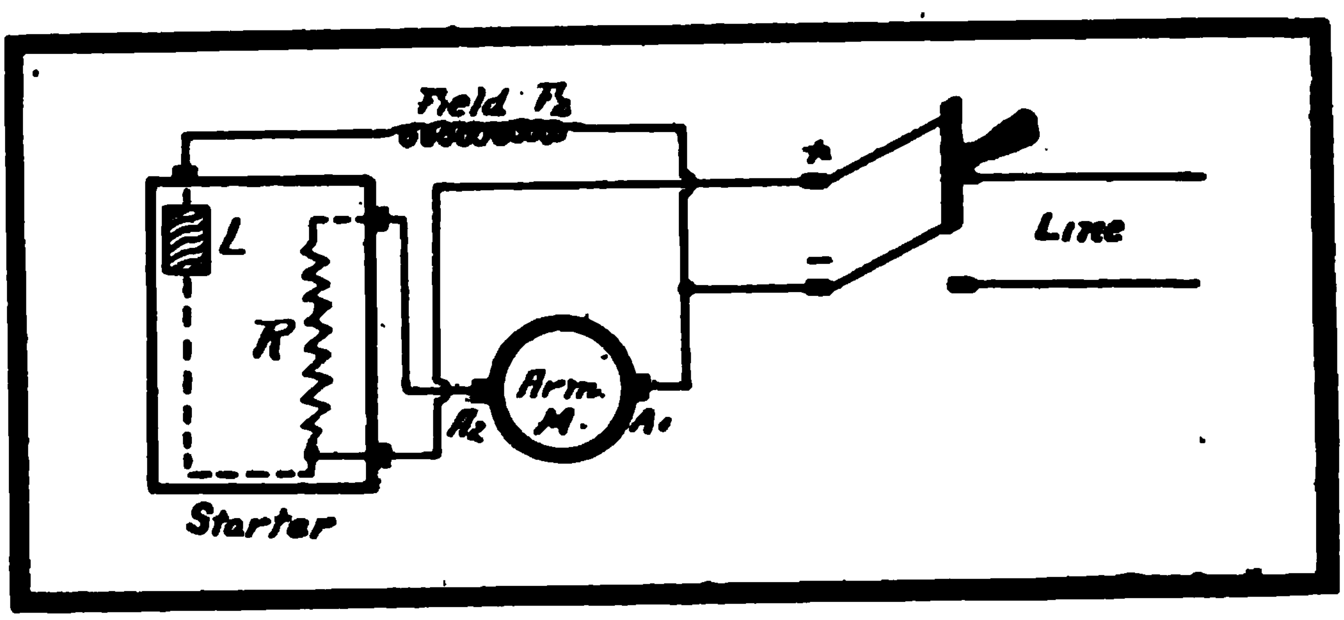
Complaint is that the motor will not start the machine unless it is assisted by pulling on the belt. When it starts it sparks very badly.

The reason of this is weak field. The cause of this is defective contact in the field circuit of the starter. Cause of this trouble is probably broken discs. Remedy would be to replace discs, but at the same time it would be exceedingly advisable to furnish an independent field circuit, as, sooner or later, the condition complained of would re-occur, with the result that the field circuit will open sooner or later, while the motor is running, with consequent destruction to the armature.

The excessive heating complained of in the resistance can have no connection with the field condition, but is probably due to the operator not moving the compression lever over rapidly enough.

S. N. Clarkson, Power Engineer, Union Electric Light and Power Company, St. Louis, Mo.—The trouble lies in the field being too weak under the heavy torque required at starting. Change the shunt-field connection in the rheostat from the armature to the line side of the resistance, and if the motor will stand a reduction in the air gap, place a thin sheet steel liner under each pole. Should the increased starting torque resulting from these modifications prove to be inadequate, it will be necessary to use a compound-wound motor.

Edward A. Holtorf, Edison Electric Illuminating Company of Brooklyn.—In trying to start motor, connected as per diagram 19-53, from standstill, the field would be very weak, as the voltage impressed across the field terminals would be the line voltage minus the I. R. drop in the starting resistance. In starting from standstill the motor would probably draw from four to five times its full load current for the first few seconds, which would make the field strength very weak, due to the large I. R. drop across the



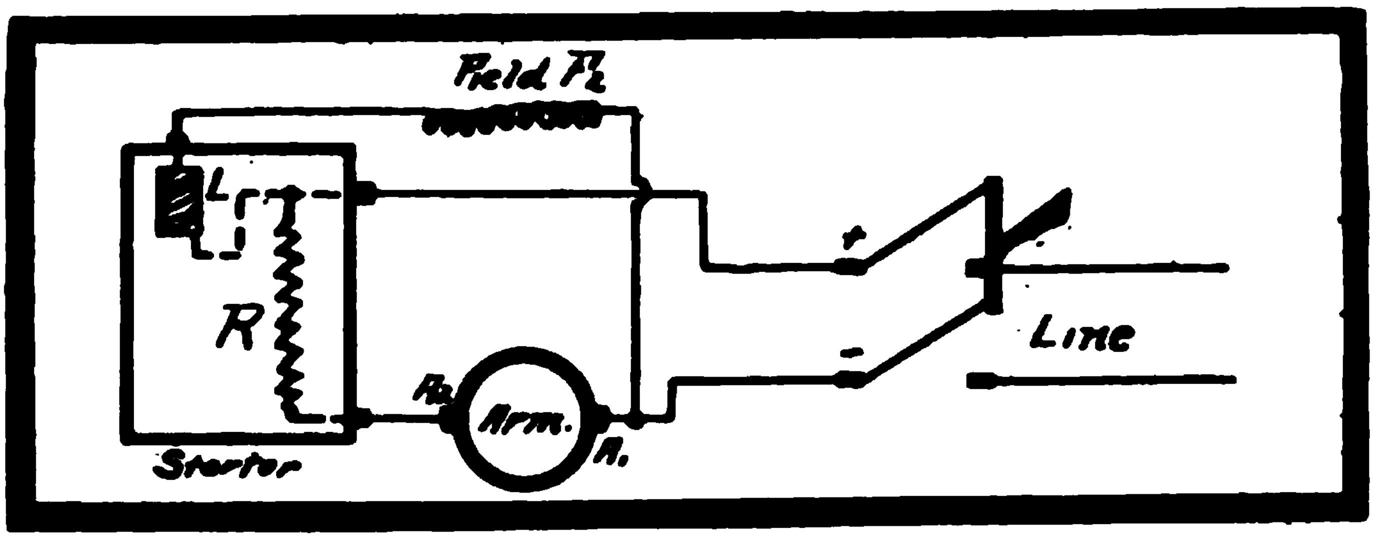
starting resistance. Consequently, the armature carrying a heavy current in a very weak field could not furnish the necessary torque to start, but when once started by some external means, would cause the field to be strengthened, continuing to rotate. It must be borne in mind that the armature is now running in a weak field carrying approximately four times full-load current, consequently, very bad commutation would result, causing sparking. When

the starting resistance is cut out the motor has full field strength, and carrying normal load would operate perfectly.

Starting the motor as shown in sketch, the external starting resistance would remain in circuit longer than otherwise, causing excessive heating.

Motor would start and operate perfectly satisfactorily if lead from L to A_2 were connected to positive (+) side of line.

Ralph W. Stearns, Schenectady, N. Y.—The trouble of this motor is due to the wiring. The diagram shows that the starting resistance is in series with the field as well as the armature when the motor is started. This is wrong, because the field will be weak, which would give a low torque, and the armature reaction would more easily change the neutral point and would cause excessive sparking until the resistance was cut out, when the motor should operate normally.



The simplest way to correct this wiring would be to interchange the leads to the starting box so as to be like that shown in the diagram below.

(Interesting answers supplied by Arthur H. Ford, Iowa City, Ia.; A. H. Robbins, N. Abington, Mass.; A. G. Rakestraw, Harrisburg, Pa., and B. S. Gramley, Waukegan, Ill., publication of which is prevented by space limitations.)

METERS

20—76a. What has been the experience of member companies with the new 25-cent prepayment meter? What is the average monthly revenue per meter? What do you figure must be secured as the minimum revenue per meter before the installation of this meter pays?

(Other answers in April and May BULLETINS.)

A. D. Quackenbush, Assistant Superintendent, Mobile Electric Company, Mobile, Ala.—Up to a short time ago we had a great deal of trouble with the new type of C P 3 prepayment meters, but upon experimenting we found that if we bent the small cam which trips the mechanism for throwing the switch slightly forward, all trouble of opening the circuit came to an end. I think if member companies using this type of meter would try this, they would obtain more success with this type of meter.

20—77. Have any member companies made any tests with oil for use with meter jewels?

(Also answered in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—We had to discontinue the use of oil on meter jewels, as we found it gave us considerable trouble and interfered with the accuracy of the meter on account of the tendency of the oil to gum up and collect dirt, which retarded the meter.

William Bradshaw, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.—We have been carrying on for some time investigations and experiments in connection with the use of oil for meter jewels, and had

some experiments and tests which we hoped would be far enough advanced to allow us to benefit by the results of same in submitting a reply for publication in the May BULLETIN. However, these tests were not finished in time, but are just now completed, and we give you herewith our views in connection with this subject.

The tests with various makes of oil have shown that it is difficult to get any mineral oil which will have a sufficiently low evaporation to answer the purpose of a jeweler's oil. On the other hand, a jeweler's oil which is purely an animal oil if present in any quantity and exposed to the air is liable to turn rancid and in this acid condition attack the bearing pivot.

From the various tests and experiments which we have made, we would strongly recommend the use of oil for the jewels in meters, but in a very limited quantity. The flooding of the bearings with oil is open to the objection mentioned above in connection with the animal oil. It has been our practise to have just a trace of oil on the bearings for years, and so far as we can judge from present conditions and our past experience, this practise seems justified. We would therefore give you as the company's answer to the above question—we have carried on a continuous investigation and tests in connection with the use of oil for meter jewels, and recommend that a trace of oil be used.

20—79. We have a customer whose installation calls for a 100-ampere meter on a single-phase, 110-volt, lighting service. Which would be the best, to install a 100-ampere meter or to install a 100-ampere, 20 to 1 ratio, current transformer, with five-ampere secondary windings, and a five-ampere, 110-volt single-phase meter?

The above proposition is one that is of great interest to us, and before deciding on just what course we wish to follow on services of the above mentioned size, we would like to know what the opinion of others is regarding same.

Gordon Weaver, New Business Department, Kansas City Electric Light Company, Kansas City, Mo.—It is very much better practise to have all alternating current watt meters, either single or three-phase, made to operate on 110-volts and 5 amperes, and use potential and current transformers whenever necessary. This arrangement makes meters absolutely interchangeable.

W. E. McCoy, Electrical Engineer, The United Electric Light and Power Company, New York.—The practise of this company is to install, wherever possible, a self-contained meter. The Public Service Commission for the First District requires certified copies of laboratory tests on transformers when used in connection with meters.

E. F. Dixon, Foreman of Meter Department, North Shore Electric Company, Chicago, Ill.—We have always found it good practise to use a five-ampere meter with current transformers having secondary windings of five amperes. The constant of the meter will depend upon the ratio of the current transformer. By using an equipment of this kind it will enable the inspector to test the meter without interfering with the customer's load.

W. H. Fellows, Superintendent Meter Department, Potomac Electric Power Company, Washington, D. C.—Install the 100-ampere meter, then you will not have any transformer ratio to enter into the meter accuracy. The meter alone will have a better accuracy on overloads than with a transformer, and therefore a smaller ratio of meter capacity to connected load would be allowable. A 100-ampere meter, if installed in a residence, should have a connected load of about six hundred to seven hundred 16 candle-power equivalents. As rotating standards are now made up to, and I believe beyond, 100-ampere capacity, there should be very little difficulty in testing meters of this capacity on the customer's premises.

William Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—The most efficient and economic practise would be to install a 100-ampere self-contained meter.

The use of current transformers should be avoided as much as possible, except on high potential circuits, due to their uncertain performance. The cost of maintaining a meter and transformer is much higher than that of a self-contained meter, and is not as reliable.

J. K. Himes, Foreman Meter Department, The Dayton Lighting Company, Dayton, Ohio.—This company occasionally uses this method of metering installations when a self-contained meter of the correct size is not available, but we always make a test on the meter immediately after installation, testing the meter and transformr as a unit. This is undoubtedly a good method, but before going into it extensively, would suggest that you read the paper which was presented before the National Convention at St. Louis, in 1910, Volume I, pages 949-961.

A. D. Quackenbush, Assistant Superintendent, Mobile Electric Company, Mobile, Ala.—We have a great many power and lighting installations in which we use both current transformers for our meters, and also meters without current transformers. In this particular installation we do not see any particular reason why a current transformer should be used.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—We should advise the use of a self-contained meter, as they are more accurate over a wide range than transformer coils and five-ampere meter. Also, unless meter was purchased of manufacturer for use with current transformer, there would be an odd constant, which increases the chance for errors on records.

Arthur H. Ford, Consulting Engineer, Iowa City, Iowa.—The installation of a five-ampere meter with a 20 to 1 current transformer would be preferable, because a meter of this capacity can be calibrated, removed for repairs and replaced more easily than one with a 100-ampere current coil. Where a number of large current capacity meters are used, the number of reserve meters which must be carried in stock is reduced if current transformers with five-ampere secondaries are used for all.

A. H. Robbins, The Electric Light and Power Company of Abington and Rockland, No. Abington, Mass.—Install a 100-ampere, 20 to 1 ratio current transformer, with five-ampere secondary windings. Use a five-ampere, 110-volt meter with dial ratio suitable for a 20 to 1 ratio. The above arrangement can be easily handled, and will permit testing with ordinary equipments.

A. D. Spencer, The Edison Illuminating Company of Detroit, Detroit, Mich.—It is desirable to avoid current transformers wherever possible. The only advantage gained by using transformers is in the use of a smaller meter which can possibly be calibrated more easily. On the other hand, where current transformers are used, the meter requires special calibration, including special adjustment of the lagging device. When such a meter is tested as a meter alone (without current transformers) it is necessary to apply correction, which correction will depend upon the load and the power-factor. It is always advisable to test meters with the transformers at certain intervals, as errors may develop in the transformers themselves. Generally, a meter with transformers costs more than the larger size meter which would be necessary without the transformers.

V. L. Board, Denver Gas and Electric Company, Denver, Colo.—It seems to me that the latter arrangement is preferable, and is the one generally practised by the Denver Gas and Electric Company. It possesses the advantage of lower cost, particularly where the transformers can be manufactured locally. Also, the transformer method is more flexible under conditions that arise in installing meters—the heavy leads do not have to be carried through the meter itself.

Allegheny County Light Company Section, Pittsburgh, Pa.—The 100-ampere self-contained meter will give the more accurate registration of the energy passing, but will involve more difficulties from the tester's standpoint unless the service can be interrupted at will, or some special device is provided for shunting the load. There are current transformers on the market that are accurate to within two per cent from 20-per cent load to 150-per cent load at 25 to 60 cycles. Current transformers involve some danger from high-voltage surges if the secondary circuit is opened when the primaries are carrying load. Moreover, the accuracy of the transformer is impaired from the same cause. Both of these, however, are easily avoided by opening the main switch for an instant while opening the secondaries of the converter.

20—80. Please explain the advantages and disadvantages of connecting meter as shown in the diagram; also show best way to connect up such a meter. Why will you receive a shock on touching the motor commutator with connections as shown?

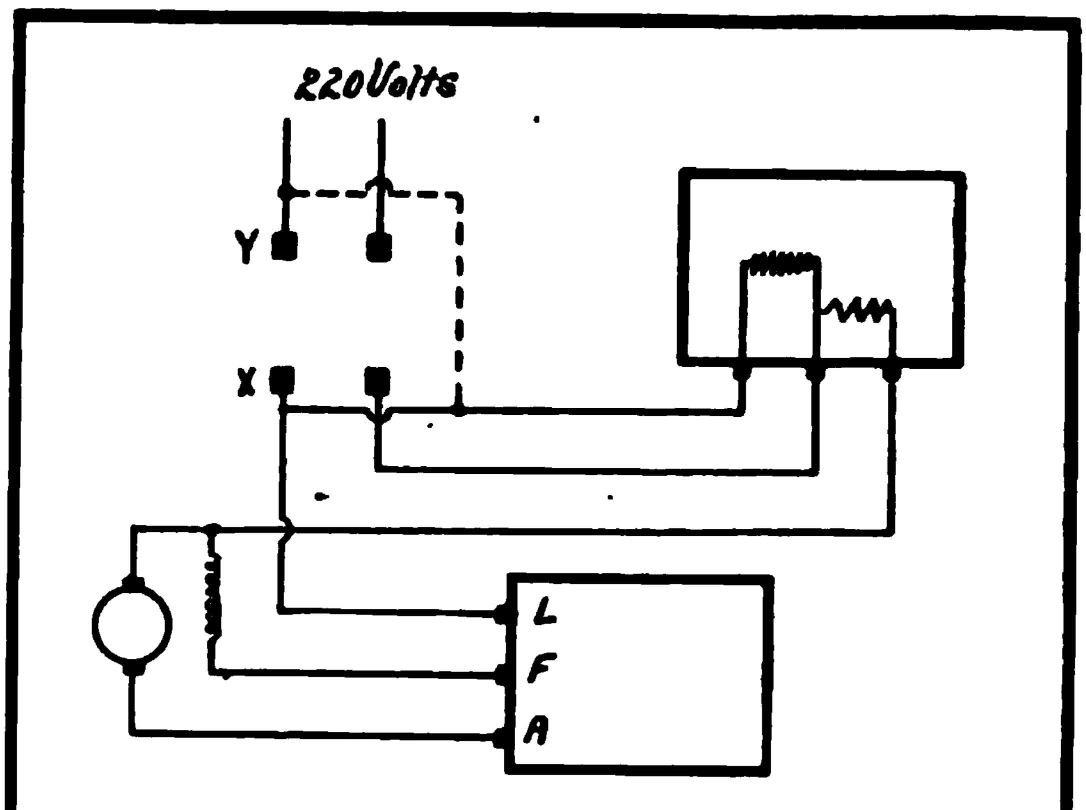
(See May BULLETIN, page 643, for Diagram referred to.)

L. E. Northshield, Inspector of Electric Meters, State of New York Public Service Commission, Second District, Albany.—One advantage of this connection is that while the motor is not in operation and the switch open, there is no possibility of the meter creeping. On the other hand, there is the disadvantage of a slight over-registration for a short time after starting, due to the potential circuit being cold.

A better arrangement would be to connect the meter ahead of the switch.

J. K. Himes, Foreman, Meter Department, The Dayton Lighting Company, Dayton, Ohio.—This company will not install a meter under conditions of wiring as shown in the diagram. The wireman is required to install a switch for each motor between the meter and the motor. This prevents the "inductive kick" of the motor, at the instant of opening of motor switch, from dissipating itself on the shunt winding of the meter, which is very frequently open circuited as a result. The shock received is due to the fact that the motor armature and field are alive to one side of the line through the shunt winding of the meter.

A. G. Rakestraw, Harrisburg, Pa.—The potential coil should be connected to X as shown by the full line instead of at Y as shown dotted. There is no reason why the potential coil should be connected to the live side of the main switch. If, however, the connection is made to the live side of the switch as originally shown, it will render all the motor windings and other parts of the circuit alive too, and in case of a slight ground on any part of the system, a person touching the commutator would receive a shock, which would not be the case if the other scheme of connection was used.



20-80

Arthur H. Ford, Consulting Engineer, Iowa City, Iowa.—The watt-hour meter should be connected with the current coil on the line side of the motor-control switch. The disadvantage of the connection shown is that the motor is always alive, due to the connection to the line through the potential coil of the meter. A person touching the commutator of the motor would get a shock if the right-hand lead is grounded or if the leads shown are part of a three-wire system with the neutral grounded.

A. H. Robbins, The Electric Light and Power Company of Abington and Rockland, North Abington, Mass.—It is assumed that the switch shown in the diagram is merely an operating switch, and that an entrance switch with fuses is installed at the entrance. With connections as shown, it is possible to get a shock from the commutator, providing a ground exists on the opposite side from that on which the potential tap is taken off. A current would take the path from the line, through the potential coil, current or series coil to the commutator, and thence through the observer to the ground, and to the other side of the circuit. The meter should be installed with all connections on one side of the switch.

Allegheny County Light Company Section, Pittsburgh, Pa.—There is an apparent disadvantage in the diagram as shown, as one side of the line is permanently connected through the meter to the motor. A satisfactory method of connection would be to bring this left-hand wire down to the lower side of the switch, which would leave the apparatus free from any line connection. If the meter under consideration was for direct-current, there would be some error due to the resistance not being heated up when meter is first started. The reason for your getting shocked while the switch is out, is that one side of the line is connected through the meter to the commutator, and the other side flowing back through the ground lamps to the ground, you complete the circuit through your body from commutator to ground.

20—81. Would like an expression of opinion from member companies who have used diamond jewels in direct-current meters as to the advantages of the results obtained over the use of sapphire jewels, the difference in price being considered.

W. H. Fellows, Superintendent Meter Department, Potomac Electric Power Company, Washington, D. C.—Cupped diamond jewels have a ratio of life to cost much better than sapphire in commutating-type direct-current meter service. There will not only be a saving in this respect, but a larger percentage of accurate meters will be found where cupped diamond jewels are used. We replace no sapphire jewels with a sapphire, but invariably where a jewel needs replacing in one of our direct-current meters, a cupped diamond jewel is used. We are well satisfied with the results obtained by the use of good cupped diamond jewels and do not hesitate to recommend their use, especially in the older type of meters having the very heavy moving element.

W. E. McCoy, Electrical Engineer, The United Electric Light and Power Company, New York.—This company has no diamond jewels in use.

William Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—The use of cupped diamond jewels in direct-current meters should be encouraged, as the performance of a meter thus equipped is so much better than with a sapphire jewel that the first cost of the diamond is insignificant.

When it is considered that a sapphire jewel must be repolished at least once a year during its life of about three to five years, the cupped diamond jewel will have cost less per year than the sapphire during their periods of usefulness.

A. D. Quackenbush, Assistant Superintendent, Mobile Electric Company, Mobile, Ala.—We have done a great deal of experimenting with both sapphire and diamond jewels, and our conclusion is that with all commutator meters of above 15 amperes in capacity, and all large polyphase meters, it is policy to use diamond jewels. We test all commutator meters every six months, and before the use of diamond jewels we found a great deal of variation in these meters, but since the use of diamond jewels the meters are more nearly perfect in their calibration.

20—82. What experience have member companies had relative to the installation of meters outside of consumers' premises, and what are the advantages and disadvantages attending such practise? What is the most approved method of installation in order to render the meter accessible to meter readers, meter testers, and to facilitate inspection to determine whether service w

have been reversed between pole and meter subsequent to installation, thereby making it possible to ground the house wiring and cut out the meter?

W. E. McCoy, Electrical Engineer, The United Electric Light and Power Company, New York.—This company has no experience with the installation of meters outside of their buildings.

A. D. Quackenbush, Assistant Superintendent, Mobile Electric Company, Mobile, Ala.—In this country, where the temperature remains nearly constant, we advocate placing the meter upon the back porches if the conditions are such that they are sheltered from the rain. We find this a great convenience, as the meter readers can cover the ground in a shorter period of time.

C. A. Dean, Cambridge Electric Light Company, Cambridgeport, Mass.—We never install meters outside of consumers' premises unless we suspect theft of current, and insist that all meters be installed at point of entrance or that feed wires from point of entrance to meter be concealed or in conduit.

Our published rules cover the location of meters such as: Not over seven and one-half feet from floor; never to be located in closets or bathrooms; must be in back halls or basement of apartment houses; must not be in show windows. There seems small chance that wires would be reversed from pole to house, as line foreman understands our requirements and meter tester inspects to see if correct on each periodical visit.

Allegheny County Light Company Section, Pittsburgh, Pa.—This company does not install any meters outside the customer's premises, except in a few special cases, such as in parks, or where a customer is suspected of tampering with his meter. In these instances meters have been installed on the pole in wood boxes with glass window. In rare instances we have placed the meter on a pole in an empty transformer case in order to conceal our movements from a suspected customer. Aside from special test boxes (see manufacturers' descriptive matter), there are no particular methods by which these points may be accomplished. Both reading and testing of isolated meters are greatly facilitated by having the meter placed reasonably near the floor (five or seven feet). Where the architect provides for grouping meters in an apartment house or building, the work of reading and testing are further facilitated. By using a test lamp between the shunt terminal of the meter and the ground, the proper connection is easily determined. Your lamp should not light the shunt, or cut through side, and the ground, but should give full brilliancy between the meter loop and ground when a meter is properly installed in a grounded secondary system.

COMMERCIAL

21—28. Would like to get from members data on heating different kinds of buildings, as we find this important in trying to shut down isolated plants. Please give length of heating season, kind of building, pounds of fuel per cubic foot of building for heating season, price of fuel per ton of 2240 pounds, kind of heating system used and pressure required.

(Other answers in May Bulletin.)

R. D. DeWolf, Assistant Mechanical Engineer, Rochester Railway and Light Company, Rochester, N. Y.—I am enclosing herewith copies of our data which we use in figuring the heat loss from a building. We have found that the results in Rochester, at least, check very closely with the actual demands in practise, provided a reasonable degree of economy and efficiency is used in operating the heating system. You will note that we use a method of figuring our radiation loss from windows which is different from that ordinarily employed. Our method takes into consideration the exposed wood area of the frame and window itself. We take the principal dimensions of the brick opening in the wall for the area of the window, and then use the constants as shown in the table. The constant for the window is determined in the following manner: Knowing the height and width (H and W) of the brick opening, the value of K_f is taken from the table. From this value of K_f is then subtracted the quantity shown in the right-hand side of the table, depending upon the number of panes in the window. The result is the constant to be used for the window of the particular size selected.

In going over a set of plans or data taken from an existing building, the various dimensions, etc., required, are listed on the prepared forms which I enclose. The final result of our calculations is expressed in pounds of steam or pounds of coal required in heating the building. The various constants used in calculation have been simplified as much as possible, as shown in the page headed "Results, Heating Calculations."

It is impossible to give any general data such as your question seems to request. In our vicinity, the heating season lasts from seven to eight months. We estimate on the eight months' season. It is our practise here to estimate the amount of steam used per square foot of heating surface, rather than per cubic foot of building contents. The square feet of heating surface per cubic feet of building contents vary from a ratio of 1 to 60, or sometimes less, to 1 to 130. This ratio depends altogether upon the exposure of the building, thickness of its walls, amount of glass area exposed, ventilation of the building, etc., and can be determined from the heating calculations referred to above.

The steam consumption per square foot of heating surface per season varies according to the character of the building, the use of the building and particularly the care exercised in the operation of the heating system. It varies all the way from 400 to 700 or 800 pounds of steam per square foot of heating surface per season. In certain of our large contracts we have installed recording thermometers in our customer's building, and considerable care has been taken to prevent the temperature in the building rising above the specified inside temperature of 70 degrees Fahrenheit. By these means we have been able to decrease the steam required for heating the building under extreme outside weather conditions by from 15 to 35 per cent. It is also true that if a customer who has been supplied with steam for heating on a flat-rate basis is changed over to a meter basis, it will take considerable time for him to correct his uneconomical methods which he became accustomed to using during the period when he was on a flat-rate system, and become accustomed to the use of some care to see that his building is not being overheated.

The most reliable data which I have at hand applies to modern factory buildings, and would, therefore, be of especial value to member companies desiring to close down isolated plants. I have found that such a modern type of manufacturing plant can be heated on about 600 pounds of steam per square foot of radiating surface per season. In this connection, I would point out that in taking over a plant of this character it should be noted that during the operation of the isolated plant, exhaust steam was probably available during two-thirds of the heating season in quantities greater than the theoretical amount required for heating the building, consequently, on account of this excess, the plant owner has become accustomed to devoting little attention to the operation of his heating system, and consequently has gotten little economy or efficiency out of its operation. In order to do this work on the above-mentioned figure of 600 pounds, it will be necessary for the owner to operate his heating system at a higher efficiency than he has been accustomed to doing, and consequently the central station is quite likely to find trouble during the first heating season in reducing the steam demand for heating to a proper figure.

The figures given in curve 68 are average figures taken from curve 48-1. Similarly, the figures given for the heat loss through concrete walls are taken from curves 58, 59 and 60.

Curve 60 is, I think, of especial interest, as it shows the relation between the radiation loss from solid and hollow concrete walls. You will note that there is a point where for a given total thickness of wall, the hollow wall radiates heat more rapidly than the solid wall. The thickness, however, is greater than that generally employed in concrete construction.

Fuel here costs from $2.30 to $3.00 per ton for the soft coal and from $5.00 to $6.00 per ton for the hard coal.

We are supplying a number of different kinds of heating systems, that is, both single pipe and double pipe systems, and vacuum systems. The pressure required for the system does not vary so much with the kind of system used as with the care used in the particular installation.

RADIATION CONSTANTS FOR HEAT LOSS FROM BUILDINGS.

K = Loss in B.t.u. per hour per degree Fahrenheit difference of temperature between inside and outside air.

For unexposed building to be heated during day only increase K 15 per cent.

For walls having north or west exposure increase K 20 per cent.

For exposed building to be heated during day only increase K 33 1/3 per cent.

For building to be heated intermittently, such as a church, increase K 45 per cent.

BRICK WALLS.

No. of Bricks	No Plaster Thickness Inches	No Plaster K.	Plaster on One Side Thickness Inches	Plaster on One Side K.
½	4⅛	.56	4⅞	.52
1	8¼	.39	9	.37
1½	12¾	.29	13½	.29
2	16⅞	.25	17⅝	.25
2½	20⅜	.22	21⅛	.22
3	25½	.18	26¼	.19
3½	28⅞	.17	27⅝	.16
4	34⅛	.14	34⅞	.14
4½	38⅝	.12	39⅜	.12

GLASS.

	K.		K.
Single Window	1.03	Single Skylight	1.11
Double Window	.50	Double Skylight	.62
		Sidewalk or Vault Light	1.43

WOODEN BEAM CONSTRUCTION.

	K.
As Flooring—Single three-quarter inch:	
No lath and plaster below	.45
Lath and plaster below	.26
Double one and one-half inch:	
No lath and plaster below	.31
Lath and plaster below	.18
As Ceiling:	
Ordinary lath and plaster	.70
Partitions:	
Ordinary stud, lath and plaster, one side	.60
Ordinary stud, lath and plaster, two sides	.34
Side Walls—Lath and Plaster Inside:	
Outside, 7/16 clapboards	.44
Outside, 7/16 clapboards and paper	.31
Outside, 7/16 clapboards and ¾-inch sheathing	.28
Outside, 7/16 clapboards and ¾-inch sheathing and paper	.23
Doors—Soft Wood:	
Outside exposed, 1 inch thick	.41
Outside exposed, 2 inches thick	.27
Outside exposed, 3 inches thick	.20

For hardwood increase K 15 per cent.

Fireproof Construction:

Iron beams, single flooring, cinder concrete and tile arch—

As flooring .... .08

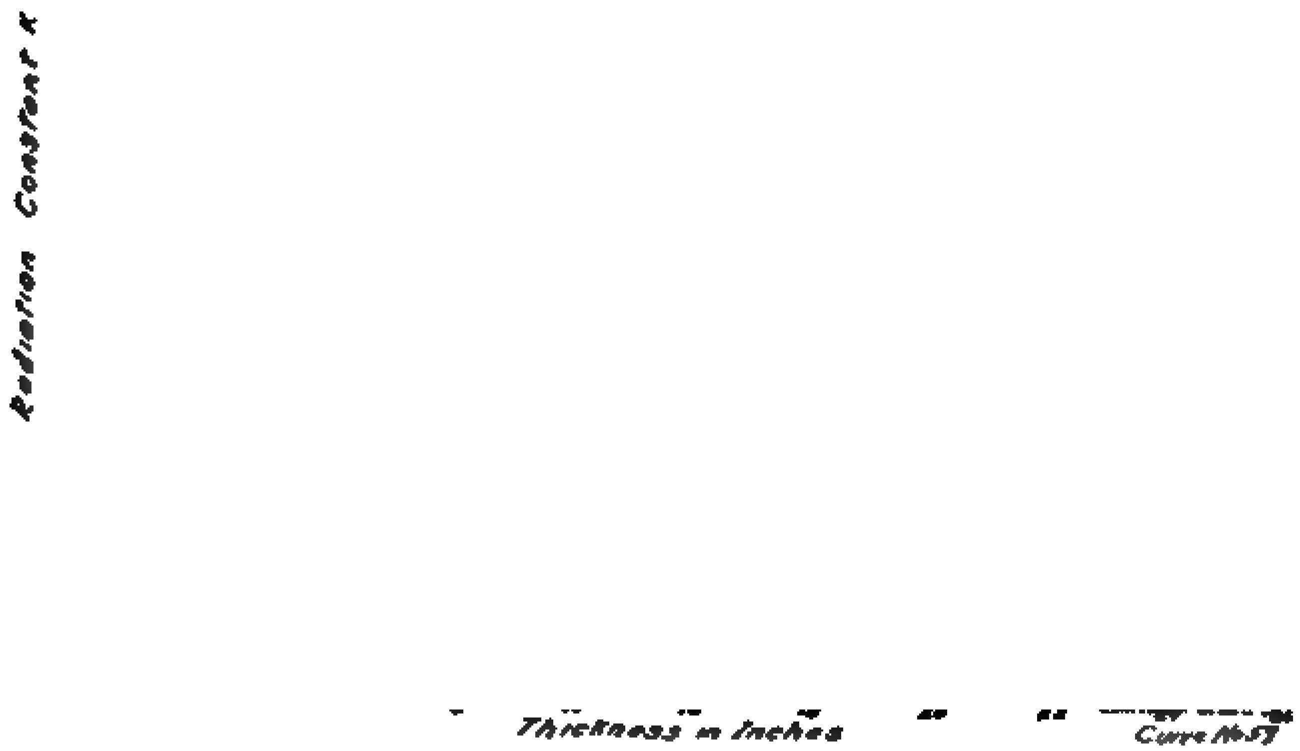
As ceiling .... .14

CONCRETE CONSTRUCTION.

Total Thickness Inches	100 Per Cent Solid K	100 Per Cent Hollow $X_1 = 1/6X_2$ K	$X_1 = 1/3X_2$ K	70 Per Cent Hollow and 30 Per Cent Solid $X_1 = 1/6X_2$ K	$X_1 = 1/3X_2$ K
6	.66	.41	.385	.48	.467
10	.55	.39	.36	.44	.41
14	.48	.375	.335	.41	.375
18	.42	.365	.316	.38	.35
24	.36	.35	.29	.36	.31

X = Thickness of each side wall.

X_2 = Total thickness of wall.




Radiation Constant K
Thickness in Inches


Radiation Constant K

Window and Door Calculations

Exposure	No.	Size	Area Sq. Ft.	H	No. Panes	Total Area Sq. Ft.	k	B.t.u. Loss per Degree per Hour

Summary of Heating Calculations

(n = No. of Changes per Hour) Vent. Loss = (Cu. Contents) (n) (.018)	Exp.	B.t.u.'s as Calculated	B.t.u.'s with Allowance

Wall and Roof Calculations.

Exposure	Dimensions	Area	Thickness	Material	K	B.t.u.

Results—Heating Calculations.

(1) Total B. t. u.'s per hour per degree____________

(2) " lb. steam per season____________

(3) " tons of coal per season____________

(2) = (1) × 161.4 and (3) = (1) × .01009 on the assumptions of heating to 70° for 10 hours per day for 6 days per week and to 60° for remainder of time; 950 B. t. u.'s per lb. steam and 8 lb. steam per lb. coal.

No. of sq. ft. of radiating surface____________

Lb. steam per season per sq. ft. radiating surface____________

	B.t.u's per Hour		Lb. Steam per Hr.		Total lb. Steam		Total lb. Coal		Tons Coal	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Oct.										
Nov.										
Dec.										
Jan.										
Feb.										
Mar.										
Apr.										
May										
Total										

	Temp. Mean	Working Days	Sundays	No. Full Working Days	No. of Saturdays	No. of Sundays
Oct.	50.7° F	26	5	21	5	5
Nov.	38.5	26	4	22	4	4
Dec.	28.4	27	4	23	4	4
Jan.	24.5	26	5	21	5	5
Feb.	23.8	24	4	20	4	4
Mar.	31.8	27	4	23	4	4
Apr.	44.4	26	4	22	4	4
May	56.6	26	5	21	5	5
		208	35	173	35	35

Average temperature for December, January and February = 25.6° F.; for other heating months = 44.4° F. Average temperature for whole heating season = 37.8° F.

K_g					$\frac{A_w P}{A}(K_g - K_w)$												
	Ratio H to W				Number of Panes												
HxW	Square	2x1	4x1	6x1	2	4	6	8	9	10	12	16	18	20	24	32	36
2	.582	.546			.0198	.0345	.07575	.0967									
4	.680	.657	.582 .		.0186	.0367	.05575	.0685	.0775	.0806	.0960	.1162					
6	.740	.717	.650	.594	.0111	.0316	.0453	.0559	.0620	.0645	.0775	.0956	.1007	.1109	.1227		
8	.772	.754	.700	.632	.0161	.0273	.0395	.0485	.0546	.0562	.0666	.0820	.0870	.0950	.1070	.1260	
10	.796	.780	.732	.686	.0145	.0245	.0354	.0433	.0485	.0604	.0695	.0735	.0775	.0847	.0967	.1135	.1178
12	.815	.800	.757	.712	.0129	.0224	.0319	.0395	.0444	.0460	.0549	.0668	.0702	.0775	.0866	.1034	.1072
14	.828	.815	.775	.734		.0345	.0297	.0366	.0409	.0425	.0500	.0620	.0655	.0720	.0800	.0963	.0996
16	.840	.828	.769	.753		.0322	.0277	.0344	.0384	.0397	.0474	.0581	.0614	.0668	.0748	.0888	.0922
18	.850	.838	.802	.767		.0305	.0261	.0320	.0365	.0375	.0448	.0548	.0581	.0630	.0708	.0830	.0866
20	.859	.847	.812	.780		.0289	.0411	.0306	.0347	.0356	.0422	.0519	.0552	.0600	.0670	.0796	.0830
24	.873	.863	.830	.800		.0271	.0376	.0280	.0316	.0329	.0388	.0474	.0502	.0549	.0614	.0727	.0780
28	.884	.875	.845	.816			.0348	.0422	.0485	.0301	.0359	.0439	.0467	.0504	.0569	.0670	.0698
32	.892	.884	.856	.829			.0329	.0402	.0457	.0467	.0335	.0411	.0436	.0475	.0532	.0630	.0650
36	.900	.892	.865	.840			.0314	.0381	.0430	.0443	.0317	.0388	.0410	.0447	.0500	.0590	.0614
40	.906	.898	.871	.848				.0361	.0408	.0419	.0300	.0367	.0389	.0425	.0474	.0563	.0583
45	.912	.906	.880	.856				.0344	.0385	.0396	.0472	.0346	.0367	.0401	.0448	.0534	.0549
50	.917	.912	.889	.863					.0366	.0376	.0449	.0546	.0348	.0379	.0422	.0502	.0521
55	.922	.916	.895							.0356	.0426	.0523	.0552	.0362	.0404	.0480	.0497
60	.927	.920	.900							.0341	.0409	.0500	.0540	.0347	.0388	.0459	.0473
65	.932	.924	.904										.0551	.0354	.0372	.0441	.0456
70	.937	.928	.909											.0336	.0360	.0425	.0439
72	.939	.930	.911											.0327	.0355	.0419	.0434

WINDOW CONSTANTS (CURVE No. 65).

Alton S. Miller, President, Union Electric Light and Power Company, St. Louis, Mo.—Information on Heating Buildings in St. Louis. (Inasmuch as the cost and quality of fuel varies greatly in different sections of the country, I have used, as a basis for tables, the pounds of steam per month, instead of giving the coal or the cost of heating.)

The buildings to be dealt with can be generally described as follows:

One is an up-to-date office building with the very latest improvements in heating equipment. The second is a similar building with not so many improvements. The third is a hotel, the heating system of which is not equipped with the most up-to-date devices for economical operation. The fourth is a combination of printing house and office building, with an old-fashioned system, and the fifth is a warehouse with an up-to-date heating system, but only requiring 55 degrees temperature and a 12-hour service. Buildings Nos. 1, 2, 3 and 4 have to be maintained to 70 degrees 24 hours a day.

Building No. 1: Is an 18-story modern office structure of approximately 2,000,000 cubic feet contents. Steam is generated at low pressure in a down draft water tube boiler of 250 horse-power. There are two installed, but one is sufficient for maximum requirements. The heating system throughout the building is a single pipe direct radiation, with steam fed down from the header at the top of the building. All parts of the building, with the exception of the ground floor, are heated in this manner. An indirect radiation system and Kinnealy air washer with fan for the forced circulation of heated air is installed to take care of the ground floor. A vacuum of from 7 inches to 10 inches is maintained on the air lines by means of a Sparks-Eddins vacuum pump. The economical features of this particular system are further strengthened by the automatic regulation of the temperature in each office through the thermostatic control of every radiator valve. Condensation is returned to the boiler by gravity. In severe weather a maximum pressure of five pounds is carried.

Building No. 2: Is an equally well-built office building of 1,500,000 cubic feet, and is the same in every respect as No. 1, with the following exceptions: the boilers are straight draft water tube; there is no indirect radiation, and no temperature control of any kind other than that exercised by the tenants in each office.

Building No. 3: Is a recently built hotel of 1,600,000 cubic feet, and has merely a well designed single pipe heating system with no other means of extracting the air from the radiators than the thermostat valve on each radiator, a pressure of steam having to be carried to force the air out. This necessitates a pressure of as high as eight pounds to insure a circulation equal to that of a building carrying a vacuum system for air extracting. Steam is carried at 15 pounds pressure on the boiler to allow of giving service to a steam kitchen in the hotel. The steam for heating passes through a reducing valve and the condensation is pumped back into the boiler, which is a straight draft water tube of 270 horse-power.

Building No. 4: Is a large printing and publishing house of 1,440,000 cubic feet contents, one quarter of which is used as offices and sales room, the remainder being occupied by the printing equipment, which is operated 24 hours per day. A temperature of 70 degrees is maintained throughout the 24 hours, as in buildings Nos. 1, 2 and 3. Printing establishments require this temperature, owing to the nature of their work; factories of other descriptions are usually heated to 60 degrees. The heating system in this building is a mixture of double and single pipe radiation, with a heating main in the basement. Fifteen pounds pressure is carried on the boilers and five pounds on the house. The method of ejecting the air from the system is similar to that of the hotel mentioned as building No. 3. The boilers are of the shell type straight draft of 250 horse-power.

Building No. 5: Is a large dry goods warehouse, every portion of which is well stocked. The cubic contents are about 9,000,000 feet, one-tenth of which is heated to 70 degrees, the remaining nine-tenths to 55 degrees. The heating system is the same in every respect as building No. 2, and is only operated 12 hours per day, six days a week, with the exception of one month during the holiday season, when a 15-hour service is maintained.

All service to these buildings is furnished at a flat rate per season and no

such degree of economy can be expected as would be the case if condensation was metered and charged proportionately.

The following is a table of the steam consumption per 1000 cubic feet contents in each of the above buildings, with the prevailing outside temperature. The heating season invariably begins about the 15th of September, and heat has been furnished as late the second day of June. Hot water for sanitary purposes is furnished to all the buildings whenever steam is turned on for heating, and no extra charge is made for same, and the pounds of steam necessary for this extra service is included in the following list:

POUNDS OF STEAM PER 1000 CUBIC FEET PER MONTH.

	No. 1	No 2	No. 3	No. 4	No 5	Average Outside Temp.
September	67	80	149	98	None	70°
October	381	393	593	306	33	61°
November	785	1,128	1,049	520	321	42°
December	1,137	1,418	1,351	1,100	401	32°
January	875	1,149	1,214	1,051	351	36°
February	757	789	1,073	900	268	38°
March	589	695	945	500	225	47°
April	338	471	664	404	133	54°
May	63	188	270	275	41	61°

To estimate boiler horse-power for heating buildings to 70 degrees with an outside temperature of 10° below zero, one boiler horse-power should be allowed for every 10,000 cubic feet contents.

Davis D. Boyden, The Edison Electric Illuminating Company of Boston, Boston, Mass.

DERIVATION OF STEAM HEATING FORMULA

Heat is transmitted from a building in two ways; by ventilation and by direct radiation.

VENTILATING FACTOR

The heat lost by ventilation is by far the greater factor, amounting to from 60 per cent to 80 per cent of the total heat loss. In addition to the natural ventilation or leakage through doors and windows, mechanical ventilation may be provided.

The heat lost by ventilation depends on the volume heated and the air change per hour, and must occur in all occupied buildings, even if they have no exposed wall surface, as is the case in some theatres and basements.

1 B.t.u. will raise 55 cubic feet of air 1 degree, so that the heat units lost from a building per hour per degree difference of temperature will be

$$\frac{\text{Volume of air} \times \text{air change per hour}}{55}$$

As it is impractical to figure the air displaced by floors, partitions and furnishings, we will use the total outside volume diminished by 10 per cent. The B.t.u.'s per hour per degree will then be

$$\frac{90\% \text{ outside volume} \times \text{air change}}{55}$$

or

$$\frac{\text{Outside volume} \times \text{air change}}{60}$$

RADIATING FACTOR

Heat lost by direct radiation through walls and windows is directly proportional to the difference of temperatures on the two sides.

WINDOWS

The heat lost per square foot per hour, per 1 inch difference of temperature, through windows and frame construction, is as follows:

Single windows	1	B.t.u.	per	sq.	ft.
" " double glass	.6	"	"	"	"
Double windows	.4	"	"	"	"
Single skylights	1	"	"	"	"
¾ inch sheathing and clapboards	.3	"	"	"	"
¾ inch sheathing paper and clapboards	.2	"	"	"	"

WALLS

The heat lost through a brick wall 24 inches thick is generally taken as .20 B.t.u. per degree difference of temperature per hour.

As the height of a building increases, the average thickness of wall increases to carry the greater load. Then, theoretically, the heat loss through the thicker walls should be less, but, due to the increased exposure of the upper walls to the high winds, the total heat loss is increased rather than diminished. For this reason we will use .20 B.t.u. for all thicknesses of brick walls, and .30 B.t.u. for all granite walls.

High steel frame buildings having thin walls of equal thickness to the top should have a special allowance made for the high exposure. These walls vary so in composition, from sheet metal to imitation stone, that no definite coefficient can be here given.

ROOF

As above stated, the higher a building is the greater will be the heat losses, both by radiation and by the increased flue action of ventilators and stairways. To compensate for this, we find that by omitting the roof exposure, which amounts to less than 5 per cent of the total heat loss, the results are very satisfactory. It is evident that the higher a building is the smaller will be its roof exposure, as compared with its volume and wall exposure. By omitting this factor in all cases, a larger radiating loss is omitted in figuring low buildings than in figuring high ones.

FORMULA

The total heat units lost per degree difference per hour will be

$$\frac{\text{Outside volume} \times \text{air change} + \text{sq. ft. glass} + .2 \times \text{sq. ft. wall}}{60}$$

Now, rather than making further unnecessary assumptions as to the maximum temperature raise, allowing a certain heat storing capacity for walls and furnishings, and also, rather than assuming the B.t.u. radiated per square foot of radiation, let us take an average building which is satisfactorily heated, there neither being too much nor too little radiating surface installed, and apply the above formula for the heat loss per hour per degree difference of temperature. We will then arrive at a figure which, when divided by 5.4, will give the proper radiating surface in square feet.

$$\text{(Indirectly this } 5.4 = \frac{252 \text{ B.t.u. per sq. ft. of radiation)}}{47^\circ \text{ apparent max. temp. raise}}$$

Now, 1 b.h.p. output throughout the season will average to furnish 130 square feet of radiation. An allowance should also be made for the portion of building not heated or if not kept at 70° temperature. For example, the load-factor for a hotel might be 80 per cent, due to unoccupied rooms, or, the allowance for a factory heated to 65° would be $\frac{28^\circ}{33^\circ} = 85\%$.

The coal required per B.h.p. hour ranges from 4 to 5 pounds, according to the equivalent evaporation of the boilers with the coal in question. Wrought iron boilers in good condition and working near their rated capacity will average to yield a b.h.p. on four pounds coal.

The hours a building is occupied during the day has a material influence on the coal consumption. An office building which is closed up for 14 hours

of the 24 requires much less heat than the hotel which is open all night. Again, this is not dependent on the hours steam is turned on, for some installations are more effective or carry a higher steam pressure than others, and therefore require less hours to do the work.

To allow for this factor, we will assume a hypothetical figure for the hours of service for different classes of buildings as follows:

Hotel, 15-16 hours.
Apartment houses, 13-14 hours.
Department stores, 10-12 hours.
Office buildings, 10-12 hours.
Theatres, 6-10 hours.

CORRECTION FOR CLIMATIC CONDITIONS

For Boston climatic conditions, the heating season is taken as 210 days.

The above formula gives the coal required for the normal year.

To check this normal with the coal used for any particular season, proceed as follows:

Add the average temperatures of each of the six months, November to April, inclusive, + ½ (October + May). See how this figure differs from the normal for Boston of 263. Divide this variation by (70° × 7 mo.) — 263° — 227° rise, gives the per cent variation of coal required for that season over that required during the normal season. This is based on the fact that the coal consumption of different months (30 days) is almost exactly proportional to the average degrees that temperature has to be raised.

SUMMARY

V = outside volume including basement if heated.
G = sq. ft. glass surface, 10% being added for north and west exposure.
W = sq. ft. wall surface, 10% being added for north and west exposure.
a = average air change per hour while building is occupied.
C = constant for glass = 1. for single glass.
C = constant for wall—usually 0.2 for brick, 0.3 for stone.
C = constant for local conditions. Boston C = 5.4.
L = local factor for portion of building not heated, or for building not heated to 70°.
e = average evaporation in pounds steam per pound of coal.
d = number of heating days per season.
h = equivalent hours of service.

$$\text{Tons coal per year} = \frac{\frac{Va}{60} + C_1 G + C_2 W}{C_3} \times Ldh \times \frac{34.5}{e \times 2000}$$

Alfred S. Kellogg, Consulting Engineer, Boston, Mass.—In the latitude of New York City, with coal from $3.40 to $3.75 per ton of 2000 pounds, the cost of heating 1000 cubic feet of space varies from $1.10 to $1.30 for apartment hotels; from 90 cents to $1.10 for office buildings, and from 40 cents to 50 cents for lofts. Estimating fuel requirements based on cubic contents of space to be heated is unsatisfactory and must be considered only as an approximation; but, inasmuch as any method of calculation used, the size of the plant and local conditions so largely control the final results, the above figures may prove as conclusive as the questioner needs for his purpose. These figures are averages of several buildings of the three classes named and were compiled in 1904 and 1905. They apply only to space actually heated.

21—31. Have any member companies given complete lists of their customers to appliance manufacturers for them to circularize their advertising matter? What have been the results?

(Other replies in May BULLETIN.)

J. B. Barrett, Appliance Manager, Malden Electric Company, Malden, Mass. —About a year ago we gave a list of our customers to manufacturers of appliances—particularly the vacuum cleaner people. The result of this has been rather disastrous, for the reason that our customers have been circular-

ized, importuned and called upon until they did not want any more of our agents calling upon them.

The vacuum cleaner business has become to the housewife almost as bad as the book agents or insurance solicitors.

In view of this fact, we have deemed it advisable not to give our list of customers to any outside manufacturers.

B. W. Mendenhall, Commercial Agent, Utah Light and Railway Company, Salt Lake City, Utah.—We have offered to furnish complete lists of our customers to appliance manufacturers, and we go further than this, and are willing to enclose their circulars with our monthly bills, providing a copy of the circulars is submitted in advance for our approval. We have mailed a great many circulars in this way, and the contractors and supply dealers who have furnished them inform us that they have received a great many inquiries, and made many sales as a result of them.

22—51. Do member companies consider it absolutely necessary to have a regularly executed contract with all customers before service is connected? The idea is this: grocers, butchers, icemen, milkmen and other tradesmen regularly supply a service to householders, often amounting to several times the cost of the service we render each month, and this is done without a contract, application, or other written memoranda. Is the central station's business so different that it cannot be conducted on the same basis?

(Other replies in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—We make it a point to take a signed application from all consumers, the object of this being for the purpose of having accurate data concerning the consumer, *viz.*, his correct name, former address, collection address, occupation and references, together with other data concerning the business. The application contains certain rules which the company has laid down, and which it is proper the consumer should subscribe to. It is for this reason that the business cannot be considered on the same basis as that of a tradesman selling certain commodities to the householder, in which case the tradesman does not need to place any restrictions on the householder's use of his merchandise.

C. Alfred Littlefield, The New York Edison Company.—The practise of negotiating a contract with each customer before service is rendered seems to me not alone wise, but by far the best, for in following this plan the contract becomes the written order from the customer, and in the event of trouble arising, or the customer defaulting in his payments, the contract itself can be used as the authority from the customer for enforcing settlement, and will define, most briefly, of course, what the company will do. It is the invariable practise of the New York Edison Company to negotiate a contract with each customer before the service is rendered.

But while a written agreement is an excellent thing, a long, technically phrased, legal-appearing document is unfortunate, for a document of this kind is apt to frighten the customer and cause him to imagine all sorts of terrible consequences should there be any "slip-up" on his part in carrying out every provision of this formidable-appearing paper—a document fiercer in appearance than in practise. An application of this kind goes to all sorts of people, those who are accustomed to legal transactions and otherwise, and therefore the shorter and more concise the contract form the better, brevity rather than verbosity being that which is most desired.

The analogy between the lighting company and tradespeople does not appear complete, and right here we can learn the distinction between the words "supplying current" and "rendering service." When the butcher, for instance, accepts a telephone order, he delivers the "raw material," or what the lighting company might do should it "supply current" only. Carrying the simile further, should the butcher prepare the meat for use, having it cooked, carved and served hot, he would be in a position comparable to the lighting company when it "renders service." There are a hundred and one little things, such as furnishing lamps, replacing fuses, testing wiring, that the lighting company does without question and is glad to do, but which are not specified

in the contract, yet no question ever arises as to the thing being done promptly when a call comes to the lighting company for services of this character. Therefore, in giving to the community what the lighting company does, the plan of securing a written order from the customer can be justified on the grounds of good commercial practise and in the interest of the community as well as the company.

While the acceptance of a telephone message might be ideal from the standpoint of convenience, it would hardly be possible for a company of any size, but even in a small community I would hesitate to advocate such a plan because of obvious difficulties that would be sure to ensue.

C. A. Graves, Manager Power Bureau, Edison Electric Illuminating Company of Brooklyn.—In large communities where the customers are not personally known to the management, where there is considerable moving, and most of the premises are rented, it is expedient to secure a written contract; but in small communities it is not necessary, and in some few cases is a hindrance to securing new business.

The writer is familiar with a central station having over 400 customers for light and power which has not a single written contract or letter with its customers, and no trouble has been experienced in collections or service.

22—52. What are electric light companies receiving from municipalities having a population of three to five thousand for tungsten street lights? I would like to have this information in 40, 60 and 80 watt sizes if possible, to get a line on the prevailing rate being paid, especially in New York State, for this class of service.

P. A. Gould, Manager, Paul Smith's Electric Light and Power and Railroad Company, Saranac Lake, N. Y.—Our contract with this village is for 50 candle-power lamps. We are using instead 60 candle-power, 6.6-ampere series tungstens. The contract price is $20 per light per year, all night, every night, about 4300 hours.

Samuel Beatty, Superintendent, The Dansville Gas and Electric Company, Dansville, N. Y.—Our contract with the village was made about the time tungsten lamps were coming in use and we were particular to have it read 32 candle-power lamps, so we are at the present time furnishing 40 watts, 6.6-ampere lamps, and get $18 per year, burning all night, every night, from one-half hour after sundown until one-half hour before sunrise.

J. S. Avery, General Manager, Rockland Light and Power Company, Nyack, N. Y.—Our prices for tungsten street lights are as follows:

25 candle-power	$19 per year.
60 candle-power	28 per year.

W. E. Hemenway, Superintendent, Warsaw Gas and Electric Company, Warsaw, N. Y.—Our contract with the city was made five years ago and was for 32 25 candle-power series incandescent lamps. At that time we used carbon lamps, the contract price being $15.84 per year. Two or three years ago we changed to 25 candle-power, 32-watt tungsten lamps, price remaining same, and we hope to get contract renewed shortly at same figures.

Frank S. Fogg, Secretary and General Manager, Granville Electric and Gas Company, Granville, N. Y.—We are now negotiating with our municipality for a five-year contract for 174 40 candle-power Mazda street lights. We have no arc lights. Our price is $21 per light; each and every night from one-half hour after sunset to one-half hour before sunrise. We have a steam plant.

S. M. Strickland, Manager, Carthage Electric Light and Power Company, Carthage, N. Y.—For the 40-watt, series incandescent street light we get from the village $14 per year, we furnishing renewals. We have no 60 and 80 watt lamps in operation for the municipality.

E. W. Chapple, Manager, Huntington Light and Power Company, Huntington, N. Y.—We are supplying the villages of Huntington and Cold Spring with 40-watt tungsten lamps, street series, at $20 per year per lamp for a period of five-year contract; these lamps burn from dusk to daylight, and we have 250 street lights connected.

L. D. Ridu, Superintendent, Wellsville Electric Light Company, Wellsville, N. Y.—We have a rate on the 40-watt tungsten street lights of $18 per year.

J. C. Gapen, North Shore Electric Company, Chicago, Ill.—The town of Barrington has a population of about fifteen hundred, and is paying $18.75 for 40-watt and $20 for 60-watt tungsten street lamps on a Philadelphia moonlight to 1 a. m. schedule.

C. A. Graves, Manager Power Bureau, Edison Electric Illuminating Company of Brooklyn.—Population, 5000; town, in State of New York; burn, dusk to 1 a. m. on moonlight schedule; 180 40-watt tungstens; price, $22 per year, excluding broken lamps, which are paid for by the town.

MANAGEMENT

22—32. Do central stations draw load curves of their generator stations and substations from midnight to midnight? If not, from what points are the curves generally drawn?

(Other replies in May BULLETIN.)

T. R. Harber, Manager Meter Reading Department, Kansas City Electric Light Company, Kansas City, Mo.—It is the practise of the Kansas City Electric Light Company to draw load curves from 8 a. m., this being the first reading on our daily record sheet of station operation.

It is our opinion that it is the best practise to start the curves from a point in the period of the minimum load.

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—This company draws its load curves at generator stations and substations from midnight to midnight.

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—All our load curves and log sheets are carried from midnight to midnight, and we believe this to be the proper method, as the sheets then cover one calendar day.

23—37. What practical benefit results from the keeping of a perpetual inventory? To within what percentage of being correct has experience proved a perpetual inventory can be kept?

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—The practical benefit derived from keeping a perpetual inventory can be summed up in the statement that we obtain a more nearly accurate accounting of material in the storeroom both from a classification standpoint and from the standpoint of checking leaks due to waste or dishonesty. It is suggested that monthly inventories be taken of wire, cable and other material representing the largest money values, and quarterly or semi-annual inventories be taken of material of lesser values. With this method discrepancies can be more readily located, and, as stated above, more nearly accurate accounting can be had. This method keeps the stock and stock ledgers in balance, but it is also important to periodically check the goods on hand with the controlling account in the general ledger. This we do each year. At the end of 1910, in the 24 storerooms, representing a controlling ledger balance of $463,650, we had a net shortage of $217, or .05 per cent. This net shortage was the result of averages and shortages in the 24 storerooms, not one of which exceeded $500. The various adjustments were made to bring the stock and general ledger balance in agreement arbitrarily on the basis of the last month's issue of material. We are convinced that the perpetual inventory system enables us to come down at the end of the year with so small a discrepancy.

23—38. How do large companies handle their scrap and spliced wire, and what method is used in accounting for same?

H. F. Frasse, Purchasing Agent, Edison Electric Illuminating Company of Brooklyn.— This company has a separate account set aside for scrap wire cable and material. All scrap material when received from the job, in the storeroom is charged to this account number, and when the material is sold

the account number set aside for scrap is credited with the total amount received from scrap material sales. To take care of labor which is necessary to handle material—such as burning off insulation, dismantling machinery, in order to get at component parts—a separate account number is charged with the total expense. Spliced wire or cable is taken into the storeroom stock at full value, where lengths are long enough to make it practicable for re-use, and are delivered later to operating departments.

A. H. Bogart, General Storekeeper, New York Edison Company.—Following is a brief outline of the New York Edison Company's method of handling scrap material.

Material received at our storeroom as scrap is separated, and weight of each class of bare metal—brass, copper, lead, etc.—is taken separately, and credit memorandum showing job number and weights is issued to clerk in charge of the scrap ledger, who, pricing credit at value of last scrap sale, posts items in the ledger and forwards the original copy of credit slip to our accounting department.

Scrap cables are weighed gross, put into smelter and redeemed as pig lead and bare copper. The loss resulting from process is deducted from gross figure, the net amount only being credited to job.

As each "smelter run" is numbered (credits as received by ledger clerk also indicate the run number), the clerk is able to pro rate credits to jobs correctly. Edison mains and feeders are also smeltered, the copper redeemed being weighed and shipped to the people to whom it is sold. We invite bids for all our scrap. A copy of memorandum of shipment is forwarded to our accounting department with directions for billing.

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—Wire and cable taken down from the lines is returned to storeroom, where it is weighed and a memorandum credit card made out showing the job from whence it is returned. This return material is set aside, and on stormy days the wire and cable is sorted out and spliced by linemen, coiled on reels and credited at a second-hand value to the classification of the job from which it was returned. The labor on this work is charged to the accounts credited with the value of the wire and cable returned.

28—89. Please advise us how many kilowatt-hours there are in the term kilowatt-year.

F. B. H. Paine, General Manager, Niagara, Lockport & Ontario Power Company, Buffalo, N. Y.—There are 8760 kilowatt-hours in the year, and therefore there are that number of kilowatt-hours in a kilowatt year, or that number of horse-power hours in a horse-power year, or there are 6535 kilowatt-hours in a horse-power year. Properly, there can be no variation from this. There are a number of localities in which by a local custom 300 days are considered a year, or some other number, and in these localities the local custom has apparently arisen of multiplying the assumed number of days by 24 to arrive at the hours per year, but it is a very bad practise, it is unjustified by any reason whatsoever, and is not practised, I think, by any of the larger companies.

Load-factor.—The annual load-factor should always be calculated from the number of actual hours in an actual year. Thus:

Seventy per cent load-factor means 6132 kilowatt-hours per year consumption for one kilowatt demand.

Philip P. Barton, Vice-President and General Manager, The Niagara Falls Power Company, Niagara Falls, N. Y.—I am unable to conceive of a kilowatt-year as being anything but the product of one kilowatt multiplied by the number of hours in a year. In one or two important contracts involving large amounts of energy, I have known of provision being made for the difference between ordinary years and leap years, but in most cases for practical purposes I should consider that a kilowatt-year is equal to 8760 kilowatt-hours.

Gordon Weaver, New Business Department, Kansas City Electric Light Company, Kansas City, Mo.—There are 8760 kilowatt-hours in a kilowatt-year. This term means one kilowatt used 24 hours per day, 365 days per year.

Cecil P. Poole, Editor of "Power," New York.—The number of kilowatt-hours in a kilowatt-year depends, of course, upon the kind of service one is talking about, and as there are so many different kinds of service, I think the use of the term kilowatt-year should be discouraged. It means absolutely nothing unless one knows how many hours per day the factory or other plant is operated.

For example, machine shops running 54 hours per week will run 2817 hours per year, excepting leap years, and a kilowatt-year for such a shop will, therefore, contain 2817 kilowatt-hours. A textile mill running day and night, except Sundays, will run 7512 hours per year, excepting leap year, and a kilowatt-year for such a mill would consist of 7512 kilowatt-hours. A central station operating continuously will run 8760 hours per year, so that a kilowatt-year would consist of 8760 kilowatt-hours, This illustrates the indefiniteness of the term "kilowatt-year."

Stanley C. Tarrant, Statistician, Westchester Lighting Company, Mt. Vernon, N. Y.—The term kilowatt-year is used considerably when figuring rate statistics.

I understand it to mean a consumer's maximum demand per year in kilowatts. Supposing a consumer has a maximum demand of ten kilowatts. The fixed charges per annum would be based on this demand, regardless of whether it was used for 1 or 365 days during the year. The demand would, therefore, be 10 kilowatt-years, regardless of the length of time used during the year.

Kilowatt-hour is a term used for actual consumption. Kilowatt-year is a term used for yearly maximum demand. Therefore, the number of kilowatt-hours in a kilowatt-year depends entirely upon the number of hours the maximum demand is used during that year.

H. F. Hereley, Commonwealth Edison Company, Chicago, Ill.—The number of kilowatt-hours in a kilowatt-year is equal to the number of hours in an ordinary year, or 8760.

C. A. Graves, Manager Power Bureau, Edison Electric Illuminating Company of Brooklyn.—The usual "mill-year" is taken at approximately 3000 hours, and some engineers used that number of hours in referring to the kilowatt-year, and also to the load-factor.

It is not correct, however, for even if the electric current is not used, it is available for 24 hours per day, 365 days per year, thus differing from steam power or limited water power.

The kilowatt-year is, therefore, 8760 kilowatt-hours.

A. G. Rakestraw, Harrisburg, Pa.—The term kilowatt-year is used only in reference to the sale of power in bulk, and usually refers to the continuous supply of one kilowatt capacity for a period of one year. In this case there would be no definite number of kilowatt-hours in one kilowatt-year, but in case the full demand was called for at all times there would be, of course, 24 times 365, or 8760. In general, the term is used rather as a measure of capacity than quantity of current.

A. S. Loizeaux, Electric Engineer, Consolidated Gas, Electric Light and Power Company of Baltimore, Baltimore, Md.—In leap years there are 8784 hours in the year, and in other years 8760 hours in the year. When power is purchased on the yearly basis, the purchaser is therefore entitled to 8784 or 8760 kilowatt-hours for every kilowatt purchased, depending on whether the year is leap year or not.

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—It depends entirely how many working hours per day are counted as a day. In a full 24-hour day there are, of course, 8760 kilowatt-hours in a kilowatt-year. The term kilowatt-year, however, is frequently employed to cover a working day of 10 or 12 hours. In these cases the kilowatt-hours in a kilowatt-year would be 3650 kilowatt-hours and 4380 kilowatt-hours, respectively.

28—40. Is it or is it not good practise to eliminate meter readings from monthly electric light and power bills so that bills only show the net kilowatt-hours, rate and amount in money? What companies now practise this method?

William H. Winslow, Secretary and General Manager, Superior Water, Light and Power Company, Superior, Wis.—I presume that the omission from bills of meter readings would not be permitted in this state, as the Railroad Commission has ruled in regard to gas meters that bills shall designate the readings of the meter at the beginning and end of time for which the bill is rendered and give the dates at which the readings were taken.

It is true that they have not made a similar rule for electric meters, but from their point of view, as shown by the gas ruling, I am inclined to think that they will require it, and believe that the figures in question are something to which a consumer is entitled.

I know many of our consumers, on receipt of bill, check the readings with the previous month's bill. I should certainly not care to deprive them of this knowledge.

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—All bills rendered for electric light and power by the Kansas City Electric Light Company show the meter reading dates and wattmeter readings. I do not think it would be good practise to eliminate these items from bills.

George E. Burns, Assistant Treasurer, Commonwealth Edison Company, Chicago, Ill.—We consider it the best plan to show meter readings on our bills for electric light and power, as it seems to be more satisfactory to our customers.

A. G. Rakestraw, Harrisburgh, Pa.—I consider it an advantage to have the meter readings on the bill for both the beginning and ending of the period for which the bill is rendered.

It gives the customer a chance to check up the meter reading in case of error, and aids generally in the promotion of confidence. In some states it is required by law. I can see no possible objection to following this practise.

A. J. Goedjen, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—It has always been the policy of our company to have the customer's bill indicate the "previous reading" and "present reading" of the customer's meter. Although this method may require slightly more clerical work, it certainly reduces clerical errors and is more satisfactory to customers, a considerable number of whom actually will check their meter bills in some way or other.

By furnishing the customer with the meter statement, it provides the customer with the company's basis of calculating the bill and surely tends to instill confidence into the customer and greatly reduce the number of complaints. Inducing the customer to check the readings of the meters has a general tendency of interesting and educating the public in electrical matters, which cannot but react beneficially upon the central-station company.

Herbert S. Spencer, New York Edison Company.—From my viewpoint it would seem poor policy to eliminate meter readings from the face of the bills, as charges for electric current are confusing to many small consumers. The reading of the meter being supplied often simplifies this; the last reading taken and the present reading being supplied, affording an easy means of checking the bill from one bill period to the next, or checking the reading of the meter.

This the merchants of the East Side (New York City) do quite accurately, though not always understanding the full details of bill. The importance they place upon the accuracy of the reading aids materially in detecting meter readers' errors. This company supplies meter readings on all bills rendered for metered current.

E. J. Allegaert, General Auditor, Public Service Electric Company, Newark, N. J.—In my judgment it is decidedly bad practise to eliminate meter readings from monthly bills for electric light and power. The purpose of showing the readings on bills is to enable the customer, if he so desires, to check his bills, and any information which will aid the customer in this respect is very desirable.

E. C. Deal, General Manager, Augusta Railway and Electric Company, Augusta, Ga.—It is good practise. Have tried both ways and recommend leav-

ing them off. Keep in the office convenient records of meter readings for ready reference and the system will produce good results in several respects.

24—56. How many of our member companies keep a complete card index record of all past and present employes which may be referred to in answer to questions regarding past and present employes' ages, nationality, education, previous experience, salary, grade, and general record while employed by the company?

(Other replies in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—This company has always kept a complete card index of the record of all employes along the lines suggested in the question, and finds the record to be of considerable value.

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—We require all applicants for positions to file their history and previous experience on our regular form, which is preserved for future reference. We are now working out a record form, showing the history of each employe, date and place of employment on our system, with rate and other information. On this form entries will be made from time to time, in case of change of place of employment, rate, etc.

24—58. Do member companies compel applicants for positions in the electrical departments to undergo a physical examination, and if so does the applicant or the company bear the expense of same?

(Also answered in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—This company has a well-established medical department extending over its entire system, being under the direction of the medical director stationed at our head office in this city, and with local physicians in each town. All employes, except day laborers not engaged in electrical work, have to pass a physical examination, for which $1 is deducted from their first month's pay. No charge is made to applicants who are rejected by the medical department. All employes pay a regular monthly fee of 50 cents to the medical department, and receive all necessary medical and surgical treatment, hospital care, if necessary, even to the extent of special nursing, and free medicine. The company does not get off even, and each year has quite a deficit to meet in this department, but finds it a good investment for many reasons.

E. J. Richards, General Superintendent, Connecticut River Transmission Company, Fitchburg, Mass.—When we decide to employ applicants for positions, we require them to undergo a physical examination, the applicant bearing the expense of same.

John G. Learned, General Contract Agent, North Shore Electric Company, Chicago, Ill.—We require that all applicants for positions pass a physical examination, the company bearing the expense of same.

24—59. How many member companies are making allowances to customers where meters are found fast on routine test? If allowances are made, full detail regarding period covered by rebate will be appreciated.

(Other replies in May BULLETIN.)

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—This company makes allowance to consumers whenever meters are found to be fast, regardless of whether the test is special or routine. We generally allow the percentage of error which the test shows for about half the period which has elapsed since the previous test, it being assumed that all meters are tested when set.

It is a common error to make an allowance in the percentage which the meter is found to be fast, for in so doing one would be allowing too much. For instance, for a meter five per cent fast, the proper deduction for error would be 4¾ per cent from the amount charged; 10 per cent fast, 9 per cent reduction; 20 per cent fast, 16 2/3 per cent reduction; 30 per cent fast, 23 per

cent reduction; 40 per cent fast, 28½ per cent reduction; 50 per cent fast, 33 1/3 per cent reduction; et cetera.

H. J. Davis, Statistician, The Cleveland Electric Illuminating Company, Cleveland, Ohio.—We do not make allowances to customers where meters are found fast on routine tests.

24—60. Where central stations take flat rate sign or window lighting contracts, how are installations turned on and off, by patrol or clock switch? If the latter, what make or type of clock switch is used and has it worked satisfactorily? What troubles have arisen? Also, if clock switches are not used, how are customers who do not care to avail themselves of a "dusk to midnight" schedule, but want their window lights, for instance, turned off at 9.30 or 10 o'clock, taken care of?

(Other answers in May Bulletin.)

C. F. Farley, Manager Contract Lighting Department, Kansas City Electric Light Company, Kansas City, Mo.—This company formerly made flat-rate contracts on window signs and bill-board lighting. The lights were cut on and off by a patrolman in the employ of the company. This arrangement was not satisfactory, as we had disputes regarding the time patrolman reached installation. In some cases, customers asked for rebate because patrolman had turned off the lights before regular schedule time.

We also had trouble with customers substituting 32 candle-power lamps, when contract was based on 16 candle-power lamps. It was finally necessary to abandon the flat-rate contract, and we now handle all these propositions on a meter with an Anderson clock switch. These clock switches must be purchased by the customer.

There are many small stores in the business district who do not employ a night watchman, and they do not feel as though they could afford a clock switch, so have made arrangements with a private detective agency, who have a patrol system in the business district, to turn the lights on or off at regular hours.

24—62. Will member companies having mutual aid or benefit societies kindly advise what percentage of the available employes are members of such society?

What contribution, if any, do the member companies make towards the funds of these societies?

What are the monthly dues per member?

What is the amount of sick and death benefits paid?

Is the sick benefit limited to certain period of time each year?

Does the society refund any portion of the dues to members who sever their connection with the company, or are members leaving the company allowed to retain membership in the society by paying their dues regularly?

B. Frank Day, Secretary, Philadelphia Electric Beneficial Association, Philadelphia, Pa.—I am sending you the Fourth Annual Report of the Philadelphia Electric Beneficial Association. This completely covers the points submitted in your question.

The percentage of members to total employes, April 30, 1911, was 82.6 per cent.

[The report mentioned begins with an "Outline of Plan," which is so very interesting as showing a comprehensive and highly efficient beneficial organization, that it is reprinted here in full for the benefit of all our members.—Editor.]

PHILADELPHIA ELECTRIC BENEFICIAL ASSOCIATION.

Outline of Plan.

Organization and Object.—The Philadelphia Electric Beneficial Association is an organization composed of employes of the Philadelphia Electric Company, and of its affiliated, controlled or leased Companies, and fostered by these Companies for the purpose of establishing a Benefit Fund for the payment of Sick and Accident Benefits to its members, and Death Benefits to their beneficiaries.

Administration.—The affairs of the Association are administered by a Board of Trustees. The President of the Philadelphia Electric Company appoints annually, a Superintendent, a Secretary and a Treasurer. The

employes elect annually eight (8) Trustees from the various Departments of service. The officers of the Association are *ex-officio* members of the Board of Trustees.

CONDITIONS OF MEMBERSHIP.—Only employes of the Philadelphia Electric Company and its successors, and of its affiliated, controlled or leased Companies are eligible to membership; and all benefits appertaining thereto cease upon leaving or being discharged from the service of the Company.

WHEN BENEFICIAL.—Applicants for membership are entitled to benefits for *accidents while on duty*, immediately upon making application for membership. They are entitled to benefits for *accident while off duty*, and for sickness, immediately after examination by the Medical Director and approval by the Superintendent.

FEES, DUES AND ASSESSMENTS.—Each member pays an entrance fee of one dollar, returnable if service is terminated within thirty (30) days, without having drawn benefits. There is no reinstatement fee unless entrance fee has been returned.

Each member pays monthly dues amounting to one per cent of monthly rate.

Example: For an employe rated at $2.00 per day, and working six (6) days per week:

$2.00 × 313 days per year = $626 average rate per year.

$626 ÷ 12 months = $52.17 average rate per month.

Dues 27 cents each half month.

(Most operating positions are based on 365 days per year, and benefits are paid for 7-day week if assessments are deducted on that basis.)

COMPANY'S CONTRIBUTION.—The employing Company contributes a sum equal to the total amount contributed by the employes. (See Regulations.)

An assessment, *not exceeding* fifty (50) cents is called at the death of each member. (At present the assessment is only thirty-five (35) cents.)

All fees, dues and assessments are deducted semi-monthly through the Pay-Roll.

SICK BENEFITS.—*One-half of regular pay* for a period not exceeding ten (10) full weeks for any one disability. There is no limit placed on the separate periods of disability within any year. Each such period runs for ten weeks if necessary.

Sick Benefits are not allowed for a less period than one full week (6 or 7 days), but are paid for any fractional part of a week exceeding that period.

ACCIDENT BENEFITS.—*For injuries received either while on duty or off duty, full regular pay* for a period not exceeding ten (10) full weeks. In cases of prolonged disability on account of accident *while on duty*, beneficial period may be extended by vote of the Trustees. Separate accidents are paid for without reference to preceding periods of disability. Accident Benefits are paid for the exact number of days off, even though less than one week.

Benefits are paid for "accident while on duty," without regard to "cause or blame."

DEATH BENEFITS FOR NATURAL OR ACCIDENTAL DEATHS; ON DUTY OR OFF DUTY.—An amount not to exceed five hundred dollars ($500), raised by the assessment of the members, together with an additional amount contributed by the employing Company equal to one-half the sum raised by the assessment of members, and if deceased member has been in the employ of the Company for five consecutive years an additional sum of two hundred and fifty dollars ($250) is paid from the Treasury of the Beneficial Association.

Practically since date of organization the minimum Death Benefit has been $750, and the maximum benefit of $1000 has been paid in all cases where deceased member has been in the service for five years.

NOTIFICATION AND MEDICAL ATTENTION.—Members are required to notify their employing officer immediately if *sick* or *injured*, and benefits do not begin until this is done.

When sick, members are required to either visit the Medical Director at his office, or to *immediately* send the certificate of their attending physician.

In cases of "accident while on duty" if the member has given full details of the accident to his employing officer, the department report of "accident to employe" is accepted in lieu of medical certificate, but employe is required to keep in touch with his department, unless confined to the house; this is also required in cases of sickness.

All attention and treatment is absolutely free to members who visit the Medical Director at his office.

Members must give their employing officers prompt written notice of any change in address. This must be forwarded to the Association.

Strict compliance with the regulations as explained above is insisted on.

C. S. Walton District Agent Southern California Edison Company, Los Angeles, Cal.—In September, 1910, the management of the Southern California Edison Company gave its consent to the formation of a benefit fund among the regular employes, the lines of which were worked out by a committee composed of the general auditor, assistant general agent and the writer, who continue to administer the fund. The company assumes no responsibility in any way, but gives its moral support to the plan, which consists of providing a fund to be paid to the beneficiary of the deceased immediately upon a death occurring, and without the formalities of proof of loss or any other red tape.

Employes in order to join the fund sign a card authorizing the treasurer to deduct the sum of $1 from their pay and place same in the fund. They agree that in event of ceasing to be a regular employe of the company all rights in and benefits from the fund shall cease. They designate the beneficiary and the signature of the employe is witnessed.

The treasurer of the company has been designated custodian of the fund, which he keeps in a separate bank account, and pays out upon the written request of two members of the committee. There are about $700 in the fund at present awaiting payment of the next loss. This represents a membership of about 75 per cent of the employes.

The fund has paid so far two losses: one in the sum of $605, and the other $657. Each time a death occurs $1 is deducted from the pay of each employe who is a member of the fund, and in event of a death occurring before the deductions for any month have been made, the company stands ready to advance the necessary sum. In both of the cases mentioned above, the money was paid within a few hours of the death of the member.

The fund is extremely popular with all classes of employes, and has in its membership the president and directors of the company, as well as all the general officers.

The argument in favor of such a fund is that no matter what condition a member's estate might be in, a sum of ready money paid in cash immediately upon the death of a member will have a tendency to relieve the wife, or those dependent upon the member for support, of the embarrassment of having to depend on outside sources for assistance pending the administration of the estate.

It is an interesting fact that although many of the men are engaged in hazardous employment, the death rate so far has been extremely low. Both of the losses so far sustained have arisen from accident, no death having occurred from sickness. All employes are subjected to a strict physical examination before being employed, which possibly accounts for the existing showing.

Any employe may withdraw his membership from the fund at any time, and employes leaving the company may receive a refund of their dollar if they so desire. Small expenses for printing and postage in connection with the fund are borne cheerfully by the company.

We believe this fund to be one of the best of the many humane characteristics of this company.

V. L. Board, The Denver Gas and Electric Company, Denver, Colo.—This company has mutual aid association to which about one-fourth of the total number of employes belong. The company contributes an amount equal to 25 per cent of the monthly collections from the members to the funds of the association. The monthly dues are based on the salary of the member and are as follows: Those receiving $50 per month or less, 50 cents per month; those receiving over $50 and not more than $75, 80 cents per month; those receiving over $75 per month, $1.10. The death benefit is $250. The sick benefit is limited to $110 per year. The association does not make any refund to members leaving the employ of the company and under such circumstances they are no longer members of the association.

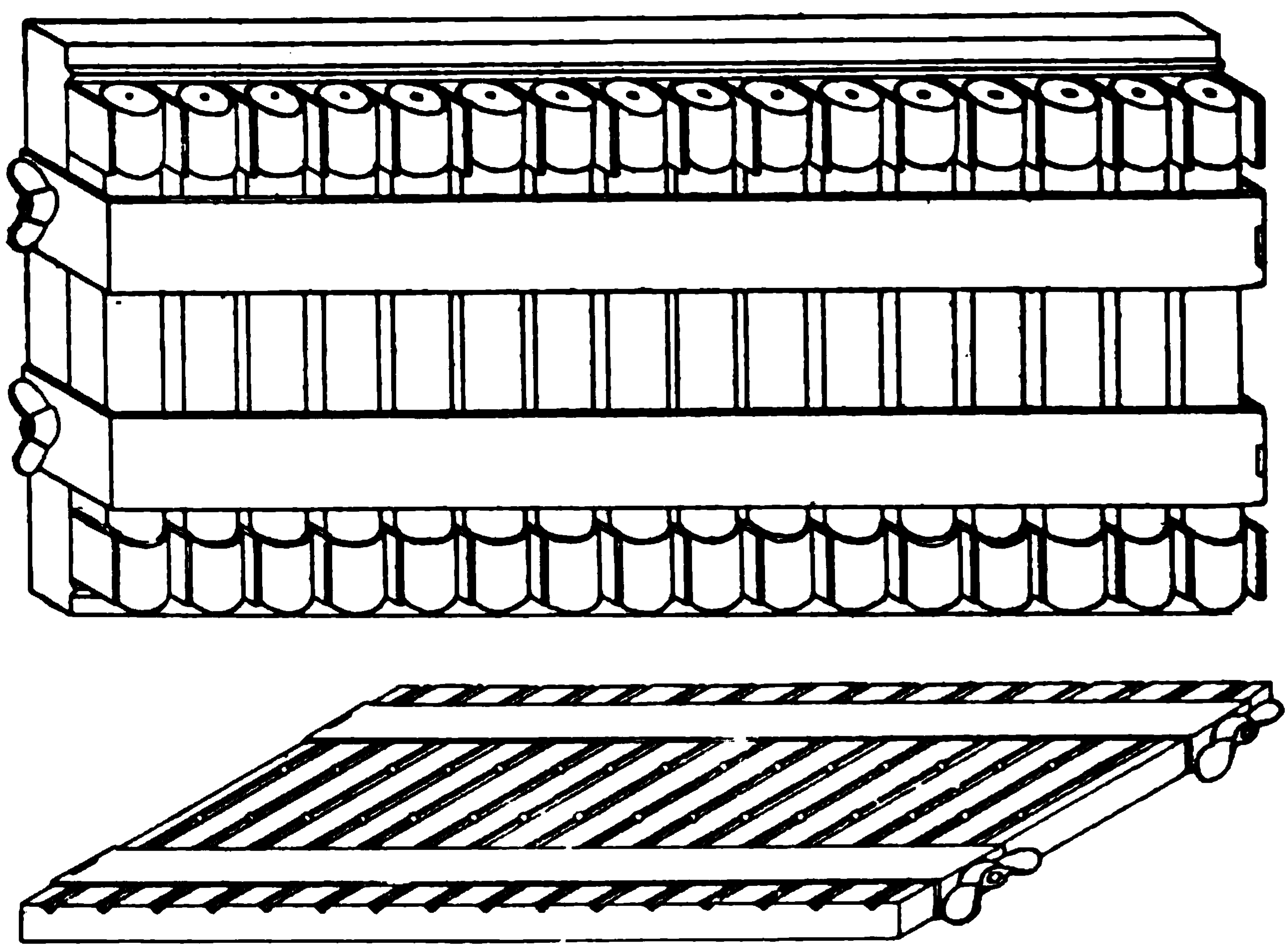
MISCELLANEOUS

0—37. Do any member companies have "blown" fuses refilled, and if so, how do they assure themselves that work is properly done? Are there any concerns that refill fuses with the approval of the Board of Underwriters?

H. F. Frasse, Purchasing Agent, Edison Electric Illuminating Company of Brooklyn.—When I came with this company five years ago, I found there were considerable quantities of burned-out cartridge fuses. When time permitted, they were assorted and separated according to size and a memo taken of the quantity of each type and amperage; then a bid was sent out to the different fuse manufacturers and for the size mostly used I found the prices quoted ran from 9 cents to 35 cents for refilling.

It was decided to refill them ourselves, and I got up an inexpensive set of apparatus that reduced the cost of refilling to about one-fourth of what it would have cost to have the job done outside.

All burned-out fuses are given to a boy, who is instructed to remove the



brass caps from the fibre tubing by loosening the screws in the ends and to save the asbestos filling to be utilized when the wire terminals have been refused.

A board about 24 inches long and 12 inches wide, as per rough sketch, is scored across the "V" shaped grooves, into which grooves the wire terminals are placed.

The next operation is to cut the fuse strips, which are a composition of lead and tin, into a certain length to blow at a given amperage, the length being specified and shown on the spools carrying the fuse wire. The wires are laid on the scored board and held down by two bands, then the best grade of wire solder with an electrically-heated soldering iron is used to attach the fuse strips to the wire terminals.

The next operation is to place one brass cap on the end of the fibre tube and draw the wire terminal through the central hole in the cap; then the asbestos filling, which had been saved, is replaced and the other cap attached and the wire terminal drawn through, making the fuse complete, but still need-

ing soldering of the terminals outside of brass caps to make complete. These wire terminals are soldered to the brass caps, held upright in a box-like frame, as per rough sketch, leaving the cartridges so that after one end is soldered, the tray or box can be reversed and the other end soldered.

After the soldering is completed, the brass clips are ground on a fine emery wheel and polished by means of a buff.

Narragansett Electric Lighting Company, Providence, R. I.—We have taken up the question relating to refilling enclosed fuses with one of the largest manufacturers of fuses, with whom we are well acquainted. They report that they have investigated this matter very carefully, and inform us that all manufacturers of standard enclosed fuses are prepared to refill the cases above a certain capacity, at a lower price than new fuses.

O—88. We have a customer who is asking us to furnish the steam and water necessary for operating his laundry, but in the absence of data or any information which might be obtained locally, we hesitate to make a figure to this party for this service. Are there any member companies which are furnishing steam and water for heating and washing and doing all kinds of laundry work in laundries located adjacent to their plant? If so, any information or figures will be appreciated.

John Richmond, The American Laundry Machinery Company, Rochester, N. Y.—If the central station in question, or any other central station interested, will communicate with us direct, we will gladly furnish them with complete information as to conditions existing in laundries, relative to steam, hot water and power.

Alfred S. Kellogg, Consulting Engineer, Boston, Mass.—Laundries will be found to be unsatisfactory customers except on a strictly meter basis, covering both the steam and water requirements. About 70 per cent of the hot water they require may be heated by exhaust steam, the remaining 30 per cent requiring live steam at 60 or more pounds pressure. The dryers and mangles require high-pressure steam, the condensation from which should be trapped and returned through a condensation meter to the boilers. The exhaust steam condensation may be treated in the same way, and, after filtering, returned to the boilers. It is difficult, however, to get a laundry customer to buy service on this plan. He wants a flat rate expressed in horse-power per year, and unless the seller of steam and power is most favorably situated with regard to the production of power at a low cost, he is likely to scare his prospective customer off by the rate charged.

If metering cannot be resorted to, then the following plan can be adopted. The exhaust steam heater should be of the close pattern with water storage capacity in gallons at least 70 times the number of machine washers in the laundry. The live steam, water-tube heater would, of course, be much smaller. One horse-power of exhaust steam, rated at 30 pounds per horse-power-hour, after deducting for drips, etc., will be found capable of raising 25 gallons of water from 50 to 180 degrees, and it has been found that most laundries require for all purposes, about twice as much steam as is required to heat their water. Therefore the charge for steam may be based on the quantity of hot water used. Meter the cold water going to their hot-water heaters, and for each 100 gallons average hourly consumption, charge for eight horse-power. Thus, at an established rate of $72 per horse-power-year of 3000 hours, or $6 per month of 250 hours, and an average hourly consumption of hot water for a given month metered 575 gallons, the charge for steam for all purposes would be 5.75 × 8 × $6.00 or $276. The electric motor power for driving the laundry machine varies and should be metered, but a laundry using the amount of hot water stated in the above example, the current required for motors would vary from 25 to 30 horse-power, and constitutes a fairly steady load. If the laundry does a towel and over-all business, the factor eight should be made nine, as such laundries have to use high-pressure steam directly in the washers at one stage of the washing process.

O—89. What comparative experience have member companies had with the two methods of resuscitation from electric shock, and what is the advice of medical men regarding the advantages of the so-called prone method and

the method of laying the person on his back and working his arms to induce respiration?

Edw. Anthony Spitzka, M.D., Professor of General Anatomy, Jefferson Medical College, Philadelphia, Pa.—That differences of opinion exist regarding the efficacy of the various methods of artificial respiration, is not to be wondered at, in view of the fact that the mechanics of respiration are still in dispute among physiologists. Of the many methods that have been proposed, the best known are, in the chronologic order of their publication:

Marshall Hall's (postural) method (1857).
Silvester's method (1858).
Howard's method (1868).
Schafer's (prone pressure) method.

The "prone-pressure" method was proposed by Professor E. A. Schafer (of Edinburgh), chairman of a committee appointed in 1890 by the Royal Medical and Chirurgical Society of London to investigate the efficacy of the various methods of performing artificial respiration. As a result of comparative experiments upon a passive living subject, the amount of "air exchange" and "tidal air" per respiration were determined during normal breathing (in this subject 13 per minute) and with the Silvester, Howard, Hall and Schafer methods. A comparative table follows:

	Air Exchange per Minute	Tidal Air
Normal breathing	5,850 c.c.	450 c.c.
Silvester method	2,280 "	175 "
Hall method	3,300 "	254 "
Howard method	4,030 "	310 "
Schafer method	6,760 "	520 "

The Silvester and Hall methods now have relatively few advocates, and time only will determine whether the method of Howard or of Schafer, or of some modification of either, will ultimately receive general adoption. In my opinion it is not merely a question of forcing air in and out of the lungs, though it is important that a sufficient amount of air exchange be accomplished. Quite as important, however, it seems to me, must be the successful excitation of the nerve apparatus governing the respiratory organs and muscles. I say this because I have been so profoundly impressed by nerve-reflex phenomena, such as ensue upon the digital irritation of the epiglottis. By this means I sought an avenue of approach—in a reflex way—to the very nerve centres involved. As stated in my articles on this subject, this manipulation resulted in resuscitation where other methods apparently failed. I have since learned that Dr. Freudenthal proposed this method in 1906, about the same time that I employed it.

The Silvester method involves the trouble of raising the arms of the subject over his head; this is exhausting work for the operator and useless for the subject, since enough air enters the lungs without it. All methods must depend upon compression of the thorax and its natural elastic recoil; traction on the arms assists the latter very little.

It must be granted that the position of the subject in Schafer's method has the advantage of preventing the tongue from occluding the pharynx, and also of allowing any mucus or fluid to run out. In Howard's method these complications can be remedied by an assistant.

Your correspondent's queries emphasize the great need now existing for subjecting the whole question to as thorough an investigation, on this side of the Atlantic, as that which was conducted in England, to the end, that then a uniform mode of instruction be imparted to all electrical workers.

1—10. What is the best kind of paint for our stacks, gas holders, and water stand-pipes? We have had experience in painting stacks and pipes, only to find the result unsatisfactory and the work to do over. Also is it wise to paint the inside of a smoke stack before erection?

T. G. O'Den, Erie County Electric Company, Erie, Pa.—We have two cooling towers at our station No. 1 that we have had up a number of years, and they

are coated with graphite paint purchased in Detroit. They have never given us any trouble so far as corrosion is concerned. This is about the only thing I know of that will stand the wear of tanks of this kind. I realize that it is a great deal different with smoke stacks, especially when a great deal of sulphur and impurities are found in the coal.

Geo. W. Teffeau, Jr., Engineer, The Willimantic Gas and Electric Light Company, Willimantic, Conn.—As to paint for stacks, gas holders and water stand-pipes, the writer has had quite some experience in painting stacks and pipes used in connection with hydro developments, and would state that after much experience, have decided there is nothing excels the Dixon Silicate Graphite paint. In regard to painting the inside of a stack before erection, would state that this is a very important matter and should be painted with heavy quick drying tar base paint. After being painted, if possible, the stack should be flooded with cement paint to give a good smooth surface on the inside, having the stack turned over so as to form a good even coating on the inside. Have known cases where the life of a stack has been increased ten years by this process and think it is worth considering.

H. P. Wood, Operating Engineer, Edison Electric Illuminating Company of Brooklyn.—Graphite paint has given this company the best satisfaction for such work as boiler fronts, steel stacks, etc., and all steel work which is exposed to the atmosphere.

A. E. Main, Electrical Superintendent, Hot Springs Water Company, Hot Springs, Ark.—In our experience we have found oxide of iron and boiled oil to be the best gas holder and stand-pipe paint. On smoke stacks have used a number of different kinds with indifferent success. The last kind tried was The Colorcraft Company's (Cleveland, Ohio) black stack paint, costing $1.10 per gallon, and this seems to be the best of those tried. We think it advisable to paint the joints inside the stack with a thick graphite to make them water-tight.

W. L. Abbott, Commonwealth Edison Company, Chicago, Ill.—A flake graphite paint ground in linseed oil affords the best protection for hot or outdoor iron work. If an unlined smoke stack is to stand unused for a long period, it will rust inside much faster than outside. In such a case, therefore, an interior cost of paint would be of more value in preserving the stack than an exterior coat of paint would be.

C. A. Graves, Manager Power Bureau, Edison Electric Illuminating Company of Brooklyn.—A stack paint which has been found satisfactory is made up of flake graphite and linseed oil with enough lamp black to give the color.

NEW QUESTIONS

0—37. The writer, a young man, would like some information as to the best method of fitting himself for the management of a central station in a growing town of 5000 people. He has charge of the office (we also operate an ice plant), but knows practically nothing about electricity. The business of the plant is rapidly increasing. The writer is financially interested, and is in line for managership later on, if he can make good. How much technical knowledge is necessary, and how can I best obtain it, without giving up my work? Do you know of a good correspondence course? Or any good books for "beginners"? Also, how can I best get the A-B-C of central-station practise?

6—6. We have a 500-kilowatt unit of some kind to install and are endeavoring to obtain data to determine whether to install a compound-condensing, direct-connected engine outfit, or a steam turbine (A.-C. system). Would like to know from actual experience which is considered the better proposition. Any data you can furnish along these lines will be greatly appreciated. While I consider an 1800 r.p.m. turbine of the larger sizes good practise, I am doubtful about the 500-kilowatt, 3600 r.p.m.

10—49. We have a 225-kilowatt, 2300-volt, 60-cycle, 2-phase, revolving-field Walker alternator, direct-connected to a four-valve, tandem-compound engine. After running this generator ten or twelve hours, it begins to lag and refuses to carry over two-thirds of its rated capacity, and after running 24 hours, will not carry more than one-half its capacity. It does not get excessively hot, and the exciter maintains its average at all times. We wish to know if any member can advise us the cause of this trouble, and how it can be remedied, and if shortening the air-gap will have any effect on this.

12—53. We make periodic inspection of all lightning arresters on our distribution system. To get a record of the performance of the arresters and spark-gaps, we insert prepared slips of paper within the spark-gap. We would like information from member companies as to methods pursued in making periodic inspections. Is specially prepared paper used for this purpose? How is it prepared? In testing the resistance of the ground connection to the pipes of water or gas system, what method and apparatus are used, and what is the maximum resistance permissible?

12—54. What experiences have member companies had with the ordinary portable testing sets, connected up for the Murray loop test in locating faults in power cables?

12—55. Have the special sliding bridges made for locating faults on power circuits been found to have any advantages over the ordinary testing sets?

12—56. What experiences have member companies had in locating faults where the conductor has burned clear of the ground by using capacity measurements?

12—57. We wish to inquire if any member companies have had experience in repairing the decayed butts of wooden poles by the use of reinforced concrete? If so, has this proven a successful method of preventing any further decay? Please give all the information available concerning the subject of repairing the decayed butts of poles, whether with concrete or any other method.

13—26. Have any definite figures been obtained, showing the comparison of life between the new fibre conduit used in underground construction and the old iron-pipe conduit?

15—59. Would like information from member companies as to experience had in fusing the secondaries of transformers operating in parallel on a three-wire, low-tension distribution system, the transformers being located some distance apart?

15—60. We have just connected a moving-picture show using about 30 amperes at 110 volts; the result is that it makes the lights all over town flicker. What is the remedy?

Would a theatre dimmer do the business? If so, what kind is cheapest and best?

20—83. What have member companies found to be the most satisfactory load for meter testing in shop? That is, for single and polyphase meters up to 150 amperes in capacity—the single-phase 110-220 volts and the polyphase 550 volts.

20—84. What is the opinion of member companies as to the practicability of a selective relay used in conjunction with, or as an attachment to service meters, for the purpose of reducing the rate of current supplied for domestic current-consuming devices, during the "off-peak" load period? This relay would be operated at definite intervals from the station switchboard without interrupting the service.

20—85. What is considered the most correct formula for figuring the percentage of a creeping meter, also the proper method of discounting a customer's bill on same. Take, for instance, a 5-ampere, 110-volt, T. R. W., or Ft. Wayne, Ind., that creeps one revolution in 3 minutes and 20 seconds.

20—86. What is the practise of operating companies, particularly in the South, in regard to location of electric meters out-of-doors; for instance, under shelter of porches, or in summer kitchens, access to which can be had without disturbing the family. Our temperature frequently drops to 20 degrees Fahrenheit. Summer temperature often reaches 100 degrees. What effect will such temperature changes have upon modern recording wattmeters?

20—87. Is it possible for an electric meter to register accurately for a period, then register too fast for any considerable period, then return to accuracy? If so, at what loads and under what conditions is this liable to occur?

20—88. Could a 3-wire, 110-220-volt single-phase, unbalanced lighting service be measured correctly with two 2-wire, 220-volt single-phase Westinghouse meters, and if so, how?

20—89. What is the basic theory upon which period meter testing schedules are determined?

20—90. What do member companies consider the proper time lag for maximum demand indicators.

20—91. It is desired to adopt a maximum demand rate for small lighting consumers. Is there an inexpensive 3-wire demand indicator on the market that could be used for this purpose?

21—32. What policy do companies pursue in the matter of advertising in programmes and miscellaneous publications of churches, schools, social and political organizations and the like? Do you consider this type of publicity to have any actual advertising value? Do you consider it worth while to spend a certain amount of money in this way, for the sake of the good-will so gained, or not? Would like to have the practise and opinion of as many companies as possible.

21—33. A laundry in this city, now renting space, is about to construct a building suitable for its business and is undecided whether to use steam or electricity for power. The managers say that if we can show them one instance where a laundry company has displaced steam with electricity for power purposes, power requirements being about 35 horse-power, and saved money, they would adopt electricity in their new building.

Can any member furnish us the data required?

22—58. What is the best reason an electric lighting company can offer for charging $1 minimum on lighting meters and $2.50 minimum on power meters?

22—54. What instruments (indicating or integrating) are used in determining, or what methods in estimating, the maximum demand of power installations in connection with contracts based on maximum demand?

22—55. Are garage owners in your city paid a fixed amount per automobile charged, or are they paid on the kilowatt-hour basis?

23—41. In order to arrive at a proper estimate of our own condition in this respect, would like to learn from companies what is the ratio of complaints to the number of customers supplied?

23—42. I would be glad to get some information on the revenue to be expected from residence connections having various numbers of lights.

23—43. We are beginning to feel that we are imposed upon by many of our customers in the matter of lamp renewals—possibly supplying neighboring towns, etc. The writer knows that some companies arrange their lamp renewals on a basis which gives a card to each customer, which card has to be presented when lamp renewals are requested. The card shows each exchange so that the company can keep tab on the number given to that particular customer. We would like to have sample cards which are in actual use, if you can secure them for us.

23—44. What division do member companies make of the turbo-electric generator for purposes of accounting, i. e., what, if any, proportion should be charged to the steam plant, and what, if any, proportion should be charged to the electric plant?

I have run across this question in connection with the appraisal of electric properties and am somewhat at a loss to know just what to do.

23—45. Will those companies supplying towns of 50,000 and over, kindly advise the cost per 50-watt lamp equivalent or kilowatt of securing new business, said cost to include advertising and soliciting? Also please advise to what account this expense is charged.

24—65. Will member companies operating in towns where colleges are located furnish information as to the method of metering, billing, etc., for dormitories? Have prepayment meters been used, and with what success, in cases where company deals directly with students.. Are deposits required when owner doesn't guarantee accounts? If owner does guarantee accounts, and rooms or suites are metered individually, is service sold at less than regular rates?

24—66. Do any companies fill in gaps on premises where the house-wiring terminations do not meet the service entry? Please give particulars as to distance, limits of concessions, etc.

24—67. On what basis do you make extensions arising in the ordinary course of business? Do you demand advance payment of a certain part of the cost by the prospective customer as an evidence of good faith, and if so, how much? What percentage of first-year revenue to cost is required before making extensions without charge to consumer? Do you repay customer his prepayment, and if so, how?

24—68. When the service to a consumer is changed from alternating current to direct current, or vice versa, does the central station pay entire cost for any necessary change in consumer's equipment?

28—2. Would like information from member companies in large cities where they are using ornamental iron poles for high-voltage series arc circuits, from underground source of supply, as to what make of pole is used. Would like to have names of such, so that we may correspond with them.

28—3. Have any member companies substituted tungsten lamps for arc lamps for street lights in sizes less than 250 and 500 watts, and, if so, what sizes have they used, and have they staggered the placing of the lamps or have they placed them opposite each other? Also what prices have they obtained from the municipalities for the different sized units? Are the citizens pleased with such form of lighting as compared with the former method of lighting by arc lamps?

Repeated Questions

The following recent questions have received no reply or else it is felt that further replies are called for and would be of value Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

0—39. What comparative experience have member companies had with the two methods of resuscitation from electric shock, and what is the advice of medical men regarding the advantages of the so-called prone method and the method of laying the person on his back and working his arms to induce respiration?

4—4. On what slope (minimum) will slack coal run? Does slope vary for open or closed chutes?

7—7. Will some member company, who has low-pressure turbines, kindly furnish some data on the following proposition:

If a reciprocating engine and generator carrying 8200 kilowatts with a 28-inch vacuum takes a water rate of 18.9 pounds per kilowatt-hour, what would be the water rate if a low-pressure turbine was connected to the engine, exhaust vacuum remaining the same, and the engine-driven generator delivering its full 8200 kilowatts and the low-pressure turbine delivering approximately 2000 kilowatts?

7—8. Will member companies who have Parson's Type Turbines kindly give experiences they have had with steel blading and with steel, copper-plated blading, also, member companies who have Curtis Turbines give experiences they have had in regard to trouble with nozzles and blading corroding?

12—47. If all the station output of single-phase, 2300-volt, 60-cycle current for incandescent lighting is metered at the station and all the customers are on meters, in a town of 5000, what proportion exists in actual practise between the total consumption as indicated by the customers' meters and the total output of the station as indicated by the station meter? In general, what per cent of the loss is chargeable to line, transformers, meters—what else?

13—24. What rules are member companies pursuing in regard to bending of high-tension lead-covered cables, and approximately what proportion of cable faults occur at bend?

14—7. Have any member companies had any experience with the Edison Battery for vehicle work? Would certainly appreciate any information we can get on this subject.

15—57. In a transformer station with two step-down transformer banks, one 1200 kilowatts capacity and one 400 kilowatts capacity, Westinghouse oil-cooled transformers, connected in parallel on 6600-volt, three-phase, 60-cycle system, using Scott connection, transforming to two-phase, 2200-volt, four wire:

When banks are tied in together either on 6600-volt end or 2200-volt end, at times we get dips of from 2 to 15 volts on lighting system.

What causes these dips, and can same be remedied?

15—58. What experience have member companies had with three-phase transformers? Do the advantages of space, economy and cost more than counterbalance the disadvantage of a complete shut-down in case of trouble?

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40- and 80-watt tungsten series lamp.

16—41. What experience, if any, have member companies had in the use and installing of the 400 and 500 watt Mazda units, as to life and methods of installing?

20—76. Will some member company give information in regard to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

20—81. Would like an expression of opinion from member companies who have used diamond jewels in direct-current meters as to the advantages of the results obtained over the use of sapphire jewels, the difference in price being considered.

20—82. What experience have member companies had relative to the installation of meters outside of consumers' premises, and what are the advantages and disadvantages attending such practise? What is the most approved method of installation in order to render the meter accessible to meter readers, meter testers, and to facilitate inspection to determine whether service wires have been reversed between pole and meter subsequent to installation, thereby making it possible to ground the house wiring and cut out the meter?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

22—37. What member companies give off-peak rates? How are these rates controlled and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

23—37. What practical benefit results from the keeping of a perpetual inventory? To within what percentage of being correct has experience proved a perpetual inventory can be kept?

23—38. How do large companies handle their scrap and spliced wire, and what method is used in accounting for same?

23—40. Is it or is it not good practise to eliminate meter readings from monthly electric light and power bills so that bills only show the net kilowatt-hours, rate and amount in money? What companies now practise this method?

24—61. What member companies hold regular meetings of their employes or department heads?

24—62. Will member companies having mutual aid or benefit societies kindly advise what percentage of the available employes are members of such society?

What contribution, if any, do the member companies make towards the funds of these societies?

What are the monthly dues per member?

What is the amount of sick and death benefits paid?

Is the sick benefit limited to certain period of time each year?

Does the society refund any portion of the dues to members who sever their connection with the company, or are members leaving the company allowed to retain membership in the society by paying their dues regularly?

24—63. Has any member company experience with more than one kind of addressograph? If so, which one gives the best results? We require a new one almost at once. Number of accounts struck off daily, 1500, and a daily average change of 45 names and addresses.

24—64. Have any member companies made any attempt to introduce the Taylor system of scientific management into any department of their power plants, or any other department of their organization; if so what have been the results?

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

National Electric Light Association

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NATIONAL ELECTRIC LIGHT ASSOCIATION BULLETIN

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July 28, 1911

CONTENTS

THE CLASSIFICATION OF ACCOUNTS

For years past the best energies of the Association have been directed toward securing uniformity and standardization in methods of central-station bookkeeping. In this work there is not involved any attempt to enforce an elevated and impossible ideal on the art, but a recognition of the fact that in all such public utilities, big and little, the main items of accounting are the same, that such items can all be reduced to a common standard, and that without such a basis there can be no opportunity for any kind of comparison. In these days of public inspection, which penetrates the individual home quite as minutely as it does the public utility, there can be no escape from supervision of one kind or another; but the edge of such inquisition is blunted when the utility itself has adopted rational and scientific methods of bookkeeping. More than that, a company, for its own sake, whether there be inspection or not, needs some kind of introspection, and that is just what a uniform system of accounting gives it.

The officers of the Association, in view of what has been done, are desirous to see its uniform system of accounts adopted, and are now urging it upon the smaller companies in membership more particularly. In some instances this adoption is limited by the fact that the new Public Service Commissions are now multiplying so rapidly; but here again comes in the desirability of getting all the commissions, as far as possible, to adopt our standard uniform system, almost as a matter of course, alike for private companies and for municipal plants. The obvious advantages are numerous alike to the communities served and to the companies.

We are heartily glad to note that the new Public Service Commission of Maryland has just formally recognized our uniform system, and in its regulations, issued last month, has provided that any central-station company in the state can keep its books in the manner prescribed and defined by the N. E. L. A. system. It is a happy coincidence that this significant step has been taken in Chairman Bailey's own state, and a direct relation can doubtless be traced between effort and result; but what has been done in Maryland ought to be done elsewhere, more especially with the new commissions. Before they go off on the paths of dissimilarity and heterogeneity, let us get them committed to uniformity. It will save a lot of trouble for everybody in the long run.

In this connection it is interesting to note that years ago the American Electric Railway Association did a lot of pioneer work in this matter, and formulated an excellent system of accounting. The national government has recognized this, and all its census work related to the industry is based on that system, thus giving it a universality and weight it could never have had of itself in regard to companies not using the system. By working with the commissions we can achieve equally useful and important results in our own case. The Association desires to co-operate with the member companies in any state in this matter, and invites correspondence and suggestions.

WELFARE WORK

The report of the Public Policy Committee, on what is generally known as welfare work, adopted at the last annual convention, has attracted considerable attention throughout the country, and a great many applications for copies of the report have been received at the Association offices from other bodies as well as from individuals. The public interest thus evinced is felt also in the industry at large and within the ranks of the Association. It has been estimated that to-day not less than 100,000 persons are employed by member companies, and if only half of these are heads of families, and the average family be taken as five persons, it is evident that the welfare of at least 250,-

000 persons is directly affected by the report. The real number is no doubt greater.

The question thus arises, and presses for early settlement, as to what shall be done with the report so that it does not become a dead letter, but is effective for good. One of the first efforts of the Gilchrist administration will be to secure a satisfactory answer to that question. The report of the New Theatre session at which the report was read, and speeches were made, is now being put into type, to be issued as a special pamphlet. It is then proposed to ascertain from each member company just what it has done, or proposes to do in the near future, along any one of the lines laid down by the committee. This will result in the collection of some very valuable data for a whole industry in regard to its welfare work, and will doubtless develop various important ideas or suggestions as to methods of operation and administration for such plans. What some of the larger companies are doing is well known, but no figures at all are in existence as to what the central-station industry is doing, or, more specifically, the member companies of the National Electric Light Association. It will be most interesting to see, therefore, the data brought out by the inquiry that is shortly to be made in the manner outlined above; and it is earnestly requested that all member companies will cooperate by furnishing promptly, when requested, the details of their welfare work, if any, already in operation.

JULY MEETING OF THE EXECUTIVE COMMITTEE

A meeting of the Executive Committee was held on July 10 at 11 A. M. at the offices of the Association, New York City. Present: Mr. John F. Gilchrist, president; Messrs. C. L. Edgar, W. C. L. Eglin, W. W. Freeman, A. R. Granger, H. H. Scott, H. T. Sands, F. M. Tait, A. Williams, H. A. Wagner, T. C. Martin, secretary. Past-President E. H. Davis was in attendance by invitation, and Mr. C. H. Hodskinson, master of transportation, in connection with the question of railroad facilities of the Seattle convention of 1912.

The date of the Seattle convention was discussed, and on motion of Mr. Eglin it was voted to hold the convention the second week in June, as that time had been recommended by the Seattle hotel men.

The secretary read the financial statement as of July 1, 1911, showing a total balance of $28,478.82, including bonds and deposit in Boston, as compared with $22,092.68 on July 1, 1910. The printer's bill of $6,399 for 1911 Convention papers, still to be paid, made the balance for each of the two years practically the same. The financial statement showed that $18,482.42 had been expended for the convention, which, with the outstanding bill of $6,399, made a total of $24,881.42, being below the average per capita of recent years. The amount collected for convention expenses from the percentage dues and registration fee was $17,523.37, leaving a deficit of $7,358.05 to be paid out of the regular Association funds. On motion of Mr. Williams, the financial report as submitted was accepted. On motion of Mr. Williams, it was also voted that the expenses of the various convention committees be approved,

subject to the usual audit. The registered attendance at the convention was 5438, or more than twice that at St. Louis in 1910.

The membership report showed the following membership for July 10: Class A, 965; Class B, 7150; Class C, 24; Class D, 230; Class E, 846; total, 9215. The list of new members to be acted upon totaled 1255, divided as follows: Class A, 33; Class B, 1123; Class C, 3; Class D, 14; Class E, 82.

On motion of Mr. Williams, the applications of the various Class A and Class D members were approved, also the Class B and Class E by number and Class C by name.

At the request of Mr. Scott, it was decided to change the name of the Membership Committee to the Committee on Organization of the Industry.

The legal aspects of the report of the Overhead Line Construction Committee received at the recent convention were then discussed, and a brief on the subject was presented by Past-President Davis. On motion of Mr. Freeman, it was voted that a committee be appointed to deal with questions arising under Section 4 of the report, as to railroad crossings, and the president thereupon appointed Messrs. Eglin, Edgar and Freeman as such committee.

The president announced that it was customary to appoint the secretary and treasurer for the new year at the first executive meeting of the year, and on motion of Mr. Freeman, General George H. Harries was reappointed treasurer and Mr. T. C. Martin secretary. The reappointment of Mr. Everett W. Burdett as counsel was also approved.

The president stated that he and the secretary thought that the Association should take some action on the Public Policy Report, in order to ascertain what the member companies were doing along these lines. On motion, it was voted to authorize the president to give the report such publicity as he thought fit, with the suggestion that the remarks made by Mr. Samuel Insull and Secretary Nagel at the meeting be incorporated in the report, and the complete report be sent to all Class A members.

On motion of Mr. Edgar, it was voted to refer to the president, with power, the matter of getting the smaller companies to adopt the Association's Classification of Accounts. The question was also discussed of getting Public Service Commissions to approve and adopt the N. E. L. A. Classification.

The committee discussed the suggestion made at the convention by Mr. E. W. Lloyd that the Association collect power statistics and those of a similar character that would enable all of the member companies to work together. On motion of Mr. Eglin, it was voted to appoint a committee to submit some practical plan for carrying on this statistical work.

A letter was read from Mr. B. F. Wood, district engineer of the Pennsylvania Railroad, inquiring as to the prevalence of the two leading frequencies in this country; Mr. Wood being a member of the Power Generation Committee of the American Electric Railway Association. This was accompanied by a letter from Mr. Henry L. Doherty suggesting that this was a matter worthy of consideration by the National Electric Light Association and that the Association should endeavor to establish the electrification of main lines of railroads in directions that would be of value to the central stations of the country. He therefore recommended that a committee be appointed to coöperate with the Railway Association Committee, and also expressed the opinion that it would be best and preferable to use 60-cycle current for

railway work. After discussion, it was voted unanimously to refer the matter to the Committee on Apparatus.

The secretary stated that the attention of the Association had been directed to the intention or proposition of the Dominion Government and the Provincial Government of Ontario to permit the exportation of Canadian electrical energy from Windsor into Detroit. The Hydro-Electric Commission did not feel justified in building a line to Windsor because the return would not justify the outlay, unless a large consumer like Detroit could be reached. On the other hand, if it were allowed to export to Detroit, more municipalities could be supplied with current, and thus several local central-station companies in Canada would be involved in financial and political difficulties. There is considerable feeling against the project in Canada, and it was suggested that action might be taken to induce the United States Government to prohibit such importation. After discussion, the matter was referred to the Public Policy Committee.

The secretary presented correspondence from the Northwest Electric Light and Power Association stating that the question of affiliation with the National Association would come up for discussion and decision at the convention in Spokane in September, and that information was desired as to relations with the national body. The secretary, having been already instructed to attend such convention, was authorized to communicate with the Northwest Association and to extend to that body a cordial invitation to become affiliated in the manner provided by the constitution.

The meeting then adjourned at 3.30 P. M.

Issuance of Bulletin

In accordance with previous practise, the BULLETIN for August will not be issued, but will be combined in a large double August-September number appearing early in the second month, with the general and Question Box index of this previous volume.

FINE START OF THE NEW MEMBERSHIP CAMPAIGN

In his report at the annual meeting on May 30, Mr. H. H. Scott, chairman of the Membership Committee, gave the total membership as of that day as 8665. The membership on July 17 is no less than 9297, showing a gain in the period of three weeks of 632. Some of the names included in the gain since the May BULLETIN was issued were given in the June issue, and herewith are given 203 more names. These include 16 Class A, 179 Class B, 3 Class C, 4 Class D, and 1 Class E. It will thus be seen that already in the new administration the continuing growth of the membership makes itself felt. The summer period is necessarily one of small growth, but it is encouraging to note that in the week preceding July 17 the increase was over 50 and that from various quarters applications were received for membership blanks. On July 17 the status of membership in the various classes was as follows: 966 Class A, 7223 Class B, 26 Class C, 230 Class D, 852 Class E, a total of 9297. Mr. H. H. Scott, whose brilliant leadership in the past two years has caused such a unique record to be made in growth among engineering societies, has consented to serve again under President Gilchrist. Enough said!

NEW MEMBERS

Class A: Hocking Electric Power Company, Nelsonville, Ohio; United Electric Light Company, Wilmerding, Penn.; Everett Gas Company, Monroe, Wash.; Monroe Electric Company, Monroe, Wis.; Central Electric and Gas Company, Portage La Prairie, Manitoba; Halifax Electric Tramway Company, Halifax, Nova Scotia; Trenton Electric and Water Company, Belleville, Ontario; Chatham Gas Company, Chatham, Ontario; British Canadian Power Company, Cobalt, Ontario; John Philip, Grand Valley, Ontario; Canadian Niagara Power Company, Niagara Falls, Ontario; North Bay Light, Heat and Power Company, North Bay, Ontario; Sarnia Gas and Electric Light Company, Sarnia, Ontario; Stayner Electric Light Company, Stayner, Ontario; Hull Electric Company, Hull, Quebec; Richmond County Electric Company, Richmond, Quebec.

Class B: Pacific Gas and Electric Company, San Francisco, Cal.—R. Roy Cowles.

Denver Gas and Electric Company, Denver, Colo.—C. W. Wallace.

United Illuminating Company, Bridgeport, Conn.—Edward E. Zumstag.

Georgia Power Company, Atlanta, Ga.—H. P. Broughton.

Columbus Railroad Company, Columbus, Ga.—Arthur A. Wilbur.

H. M. Byllesby & Company, Chicago, Ill.—H. M. Byllesby.

Commonwealth Edison Company, Chicago, Ill.—F. Barber, J. Barnes, George W. Bent, Charles E. Birr, Charles A. Bixby, Dave Borgstrom, Arthur H. Breuggemeyer, C. J. Carlsen, William J. Connelly, A. E. Conway, Edward H. Darst, Christian Dieden, J. Dillon, William F. Dunne, Ralph B. East, Fred W. Eppelheimer, George B. Foster, James Gately, Charles A. Gering, James G. Hailey, T. Hartnett, H. Hauschild, J. H. Hawkins, William Hildebrandt, E. V. Kendall, Fred Lichtenberger, William McDonald, Peter McGreal, M. J. McNamara, William Malooly, William Markers, James A. Martin, Frank A. Moore, John F. Moran, P. Muntges, Edward J. Neu, Clarence J. Nolan, William J. Norton, William P. O'Donnell, George Osterling, Orville Parson, A. H. Quast, C. Rohn, John Schiele, William R. Schlewitt, John C. Schumacher, Albert Sindelar, Frank M. Smith, B. F. Stewart, J. W. Suter, O. Tengberg, Fred Van Winkle, Otto A. Witte, John Ziemanski.

Illinois Valley Gas and Electric Company, Streator, Ill.—L. J. Barr, R. R. Lapp, W. B. Tingle.

Connecticut River Transmission Company, Boston, Mass.—A. O. Wilkins.

United Electric Light Company, Springfield, Mass.—Paul B. Selden.

Empire District Electric Company, Joplin, Mo.—W. C. Beachel, E. G. Britt, E. M. Hayden, F. E. Marshall.

Union Electric Light and Power Company, St. Louis, Mo.—F. H. Abbott, F. O. Andridge, Frank M. Blanchard, C. L. Brennaaun, John Ellmers, Edward H. Harrison, C. A. Irvin, C. R. Kennedge, F. W. Maloney, Robert W. Maloney, W. W. Reeve, R. R. Roberts, William L. Rose, W. F. Schader, George W. Schmidt, Albert P. Stock, Fred D. Tiffany, H. Ziegenhein.

Public Service Electric Company, Newark, N. J.—Lewis Runyon Brown, Emil Buchert.

Edison Electric Illuminating Company, Brooklyn, N. Y.—Ainsworth Boyd, John L. Keenan, James M. Meehan, Armand M. Muller.

Queens Borough Gas and Electric Company, Far Rockaway, N. Y.—Alonzo Pearsall, H. D. Wheelock.

Westchester Lighting Company, Mt. Vernon, N. Y.—Frank L. Harris.

Electric Bond and Share Company, New York City.—R. J. Hughes.

New York Edison Company, New York City.—J. D. Blauvelt, Harry L. Brayton, William Ascot Brown, Thomas Carboy, John H. Cohoon, R. C. Dahlberg, G. B. Ferguson, Cornelius J. Gwinn, William H. Hamer, H. Harris, Eric R. Hauke, Henry Heilos, Jr., Warren J. Honor, Daniel A. Jerome, James P. Kelly, E. Ludlow, Alfred J. Moore, Francis Joseph Moore, Otto D. Pipo, J. C. Robinson, Frank J. Rosback, Thomas F. Ryan, James V. Shanley.

United Electric Light and Power Company, New York City.—Frederick R. Dahl.

Yonkers Electric Light and Power Company, Yonkers, N. Y.—Martin F. Bowe.

Sapulpa Electric Company, Sapulpa, Okla.—A. A. Brown, H. B. Wales.

West Penn Electric Company, Connellsville, Penn.—C. G. Moore.

Allegheny County Light Company, Pittsburgh, Penn.—Henry Bracht, F. W. Hayes, C. J. Ober, Horace B. Pratt,

Thomas Redington, Joseph Rose, Edmund C. Stone, Frederick Trondle, William G. Waigand.

United Electric Light Company, Wilmerding, Penn.—Henry Harris.

Chattanooga Railway and Light Company, Chattanooga, Tenn.—L. J. Wilhaite.

Everett Gas Company, Monroe, Wash.—C. M. Brewer, H. H. White.

Janesville Electric Company, Janesville, Wis.—F. A. Albrecht.

Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—Benjamin C. Bugbee, Edwin H. Eckstein, Arthur C. Harris, Arthur Hegemann, H. G. Monger, E. W. Ramaker, C. H. Thornbery, Edwin W. Webster, Elmer E. Weed.

Central Electric and Gas Company, Portage La Prairie, Manitoba.—R. J. Hill.

Cape Breton Electric Company, Sydney, Nova Scotia.—Arthur S. Moore.

Electric Power Company, Belleville, Ontario.—G. B. Smith.

North Bay Light, Heat and Power Company, North Bay, Ontario.—T. Wallace.

Ottawa Electric Company, Ottawa, Ontario.—R. Chevrier, W. P. Derham, A. E. Dion, F. W. Fee, P. M. Grimes, C. G. Keyes, C. S. Pasley, F. A. Wright.

Toronto Electric Light Company, Toronto, Ontario.—W. G. Allan, E. A. Beart, W. E. Cox, Gerald Creamer, Joseph Dent, H. Doncaster, T. G. Ellis, H. G. Gardiner, Henry Hodges, William Johnston, W. H. MacQuinn, Thomas George Manley, J. W. Morris, John E. Myers, William O. Neelands, H. Tanner, E. J. Thetford, S. J. Watts, W. A. Wilkinson.

Class C: Eugene H. Abadie, St. Louis, Mo.

Clemens Herschel, New York City.

G. G. Mattern, Rochester, N. Y.

Class D: American Cross-Arm Company, Chicago, Ill.

Ward, Drouet & Foster, Inc., Boston, Mass.

Westinghouse, Church, Kerr & Company, New York City.

Holman Electric Sign Company, Toronto, Ontario.

Class E: Westinghouse Electric and Manufacturing Company, New York City.—T. W. Varley.

Officers of the Canadian Electrical Association

Note was made in the June BULLETIN of the annual meeting then in progress at Niagara Falls, Ont., of the Canadian Electrical Association. The officers elected for the ensuing year are as follows: President, A. A. Dion, Ottawa Electric Company; first vice-president, R. F. Pack, Toronto Electric Light Company; second vice-president, W. L. Adams, Ontario Power Company; third vice-president, W. L. Bird, Kaministiquia Power Company; secretary-treasurer, T. S. Young, Toronto. Managing Committee—W. C. Hawkins, Hamilton; A. L. Mudge, Toronto; C. E. Carr, Quebec; D. H. McDougall, Toronto; F. A. Chisholm, St. John's; L. V. Webber, Toronto; W. Phillips, Winnipeg; J. W. Crosby, Halifax; J. H. Wright, North Bay; J. H. Larmouth, Belleville; R. H. Sterling, Vancouver; J. W. Purcell, Walkerville; R. B. McDunnough, Three Rivers.

Officers of the Commercial Section

At the recent annual convention, the Commercial Section organized as follows: Chairman—H. J. Gille, the commercial agent of the Minneapolis General Electric Company; Executive Committee—George Williams, F. H. Gale, J. Robert Crouse, Jr., E. L. Callahan, D. Campbell, M. C. Rypinski, E. W. Lloyd, T. J. Jones, H. M. Winter, H. K. Mohr, C. W. Lee, J. F. Becker, H. J. Gille and Frank B. Rae, Jr. The last-named, who did such excellent work as secretary of the Section during the first year, has had to resign owing to the pressure of business, and the office has been accepted by Mr. Philip S. Dodd, of the National Electric Lamp Association. Mr. Dodd's publicity work is well known.

NEWS OF THE SECTIONS

ENCOURAGING MEMBERSHIP

The fact does not appear to be generally understood or appreciated that under an amendment to the constitution adopted at the recent annual convention, an individual member coming in for the half year, after July 1, pays only $3 instead of $5, the full yearly dues. The point involved is that many men who wish to join the Association during the year have felt that there should be some relation between the dues and the benefits received, and as the convention comes in the first half of the year, and several months of the BULLETIN have gone by, it is evident that the service to the member coming in after July 1 is considerably lessened. The new scale of dues meets this point, and that the change is appreciated is shown by the fact that already in the dull month of July the accessions are over 200. The $3 member not only gets his BULLETIN for six months, but his bound set of *Proceedings* and his *Handbook,* and the actual cost of production, to say nothing of the overhead charges, is barely covered by these reduced fees. The change is wholly in the interest of the individual member, and we shall be greatly surprised if it is not availed of very largely.

Another feature in the amended constitution is that which allows a company member to bring in those who are associated with it in the development of its business, although they are not, so to speak, directly on the pay roll. This includes a great variety of talent and occupation, and many companies wish to "tie in" such people, whether consulting engineers or wiring contractors, or others in close and sympathetic relation. In many instances, these members will have the opportunity to attend company-section meetings, but whether that be the case or not, the action of the Association is only another evidence of its feeling that like the unit Class A company itself, its object is to have all it can on the circuits, and to give them service that will keep them there, well pleased and cooperating for the general good.

Brooklyn Section Third Annual Convention

The third annual convention of the Brooklyn Company Section was held at the Oriental Hotel, Manhattan Beach, Long Island, on the afternoon and evening of June 21. Over 500 members and several guests, representing the New York, Philadelphia, Newark and other Sections, were present.

The afternoon session was devoted to the transaction of official business, including an address by the chairman, Mr. E. A. Baily, and the reports of the various committees. A feature of this session was the announcement of the terms and conditions of a contest inaugurated by Edison Electric Illuminating Company of Brooklyn, open to Brooklyn Company Section members, the win-

ner to be awarded a trip to the Thirty-Fifth Convention of the National Electric Light Association at Seattle.

A paper entitled "Municipal Lighting," by Mr. J. J. Leddy, was then read and discussed, also the three following papers selected from those presented at the recent National Convention:

"Reasons for Difference in Price for Different Services," by Norman T. Wilcox, read by Mr. M. S. Seelman, Jr.

"Report of Committee on Electrical Apparatus," presented by Mr. G. L. Knight.

"Tracing Storeroom Material," by J. T. Brady, read by Mr. P. M. Safford.

In the evening the delegates and guests were entertained at a banquet tendered by the Edison Electric Illuminating Company of Brooklyn.

Dr. Charles P. Steinmetz, the guest of honor, delivered an interesting address, reviewing the history of electrical engineering, and closing with practical suggestions to central-station men relating to their participation in the further development of the industry and to their personal advancement.

Mr. W. W. Freeman, President of the National Electric Light Association, and Vice-President and General Manager of the Edison Electric Illuminating Company of Brooklyn, gave a characteristic address, explaining luminously the significance of the report of the Public Policy Committee read at the recent National Convention, showing that the plan is one of mutual advantage to employer and to employe.

The Westinghouse Base Ball Cup, presented for competition at the annual conventions of the National Electric Light Association, was then awarded by President Freeman to the winning Brooklyn Edison Team. Each player on the winning team also received a gold watch, the prizes presented by the National Electric Light Association.

The following officers for the season of 1911-12 were then elected: Chairman, Mr. M. J. Shugrue; vice-chairman, Mr. C. W. Hafstrom; secretary, Mr. W. C. Pike, Jr.

Farewell Dinner in St. Louis to Alten S. Miller

On the occasion of the annual meeting of the Company Section of the Union Electric Light and Power Company of St. Louis on June 24, a banquet was given to Mr. Alten S. Miller, president of the company, as a farewell function, Mr. Miller having resigned from the company to take up engineering work in New York City. A large party met at Forest Park Highlands, where an excellent dinner was served. The following officers of the Section were elected for the ensuing year: President, R. S. Crouch; first vice-president, E. H. Tenney; second vice-president, Orrin Hull; secretary, H. G. Kislingbury; treasurer, D. H. Scullen. The Section reported a most successful year, which is due largely to the support and encouragement given to the Section by Mr. Miller since it was organized early in 1910. This was heartily recognized during the exercises, and each year at its annual dinner the Section proposes to get in touch with Mr. Miller by wire.

The toasts of the evening were: "Our Guest," by Mr. S. B. Way; "The Local Section," Mr. J. Anderson; "The Company," Mr. H. Spoehrer. Mr. J. Hunter also delivered an address, and Mr. Miller made a graceful and feeling speech in regard to his departure and his hope to see them again and often. As a mark of esteem, the following resolution was then adopted with enthu-

siasm: "Resolved, That we, the members of the Union Electric Light and Power Company Section of the National Electric Light Association, deploring the exigency which removes our president from the city, owing to his departure for New York, to take up other work of his own selection, will feel his loss keenly. As well as its founder, he has been the mainstay of our society, and to him is due the credit for its success. We have always found him kindly and considerate, and while the society fully appreciates what his departure means to us, we are a unit in wishing him the fullest measure of success in his new and larger field."

At the close of Mr. Hunter's address, he gave Mr. Miller a large album of photographs of employes in department groups, and many views of the company's stations and equipment, and presented it as partially significant of the regard and good wishes from the employes of the Union Electric Light and Power Company.

The Convention Discussion on Company Sections

In the last issue of the BULLETIN were given the striking remarks of Mr. Insull, made at the recent convention, on the value of Company Sections. Subjoined is a brief abstract of other remarks, which will appear in full in the bound *Proceedings* issuing this Fall.

Mr. Joseph D. Israel, of Philadelphia, thought that good results could be secured in section work by having a prominent man outside the company ranks deliver lectures at the section general meetings. He considered it wise to divide the membership into departmental branches, each of which would have a regular monthly meeting, at which men within the company would deliver lectures accompanied, where possible, with experiments. Good results might also be secured by having exhibits at the general meetings, with demonstrations of the latest devices, some of which might be those sold by the commercial department, and others consist of engineering devices used in the operating stations or on the lines. Another successful plan was to reward the members for suggestions or ideas.

Mr. Ernest F. Smith, of the Commonwealth Edison Company, Chicago, sketched the lines of activity of the Commonwealth Company Section. Outside of regular monthly meetings the time is equally divided between serious educational work and entertainment of a good order, all of which is furnished by company employes. There is a glee club of twenty members. While the members pay their own dues, the company contributes generously to the support and development of the section in a number of ways that show its appreciation.

Mr. R. F. Pack, of Toronto, gave an account of the work of the company section in that city. At first men were urged to write papers on the work of their departments, but this plan did not work out well. The idea was then carried into effect of having a course of lectures on more or less general subjects, beginning with one by a doctor on "First Aid to the Injured," and subsequent lectures were given by prominent men on subjects of broad general interest. The result has been that the men now realize that the company is not trying to work them, but endeavoring to benefit them, with the consequence that they increase in loyalty to the company section and to the company itself. He advised every company, no matter how small, to start a bulletin, adding that it would be better to have a two-page monthly than a larger one quarterly.

He remarked that two men were attending the convention at the expense of the Toronto Electric Light Company, one for sending in to the bulletin the greatest number of good suggestions and ideas, and the other because he contributed an excellent article on company management *vs.* municipal ownership. The bulletin also serves the purpose of enabling the company from time to time to give out announcements of its policy in such a manner that the rank and file of the employes assimilate the ideas and get into their minds the general policy of the company.

Mr. E. A. Baily, chairman of the Brooklyn Edison Section, stated that since last year the membership of the Brooklyn company section had been increased 64 per cent. After several trials the policy was adopted of having a combined business and social meeting every month. It is the aim to have a speaker from the outside at the meetings, either a leader in the electrical fraternity, a man high up in city government or some representative citizen to deliver an address, which is usually followed by one paper on a commercial and another on a technical subject, after which there is some entertainment with refreshments. The result of this plan was that the attendance has varied from 75 per cent on stormy nights to almost 100 per cent of the members, on other nights. Mr. Baily described also the annual seashore meeting and dinner, of which an account appears elsewhere in this issue.

Mr. Pen Dell, of Chicago, stated that the North Shore branch had 130 members. At first the policy was to have all papers prepared by outsiders, but at present all papers are contributed by members. There are occasional musical entertainments.

Mr. Parker H. Kemble, of Toronto, formerly editor of the Brooklyn company bulletin, spoke of the value of such publications, partly owing to bringing the work of each department before all the others, by means of which the organization is welded together. He approved lighter entertainment occasionally and outside talent giving the members a broader outlook on life and on the industry as a whole.

Mr. F. C. Henderschott, of the New York Edison Company, gave an account of the New York company sections. He described the great success of the New York Edison Section, which now has a membership of 1500. Its membership committee meets monthly and includes a representative from each of the associated companies. The adoption of a section bulletin has been of great advantage, as have also the social features.

Mr. Joseph D. Israel, of the Philadelphia Electric Company, said that through the liberality of his company, and its president, Mr. McCall, there were fifty members of the company's section present at the convention at the company's expense, who were selected on the score of their attendance at section meetings. This was not held out as a reward, as the men did not know of the matter until the previous week.

Mr. Martin J. Healy, of the Buffalo General Electric Company, gave an account of the experience of the Buffalo section. He said the greatest difficulty was to get linemen to talk, those who attend the meetings in the greatest number being members of the meter, contracting and auditing departments. The attendance is very much larger when there is a banquet or similar entertainment.

Mr. M. S. Seelman, Jr., of the Brooklyn Edison Company, referring to the size of bulletins, said

he thoroughly believed it better to confine matter to a brief than to a large space, and he believed in reducing the size of bulletins, so far as possible, in order to secure the largest number of readers. He spoke of the value of company sections as affording a means of contact between the men and those who control and direct. He suggested that at section meetings queries and answers from the Question Box might, with benefit, be discussed. He said that there was a volume of live matter on every phase of central-station activity within the covers of the Question Box.

Mr. Farley Osgood, of the Public Service Electric Company, Newark, stated that his company section had about 130 members. The reason why it is not larger is that the men are distributed from Jersey City as far south as Camden, and therefore they cannot easily get together at meetings. The company donates $500 to the company section, so that it is necessary for the men to pay only $2.50 for annual dues. The experience with linemen had been the same as at Buffalo, but the plan for the future is to have papers that will interest outside construction men in order to attract them. The reason why meter men and commercial men are more regular in attendance is that they are more accustomed to talk, through meeting the public, and thus are not timid about speaking at meetings.

Mr. Bayard W. Mendenhall, Utah Light and Railway Company, said that Salt Lake City had met the same difficulty as that referred to by Mr. Healy, of Buffalo, and Mr. Osgood, of Newark. The method was then adopted of distributing many questions from the National Electric Light Association BULLETIN, and calling on members for answers at meetings, which had proved successful.

The remarks of Mr. Insull at this session, and the editorial on them in the last BULLETIN, have been reprinted in a circular, of which copies can be had on application to headquarters.

Officers of the Nebraska Association

At the recent annual meeting of the Nebraska Electrical Association, which is affiliated with the National Electric Light Association, the following officers were duly elected for the coming year: President, H. A. Holdrege, Omaha; vice-president, F. H. Brooks, Lincoln; secretary-treasurer, S. J. Bell, David City. These officers have now entered on their duties.

The Wiring Handbook

Inquiries have reached this office as to the proposed "wiring handbook." This is not a publication of the National Electric Light Association, but is being financed, so to speak, by the National Electrical Contractors' Association and the National Electric Lamp Association jointly. At the time the matter was first under consideration, the wiring committee of our Commercial Section, Mr. M. C. Rypinski, chairman, had no funds of its own with which it could participate in the work, but the plan has hearty endorsement from the Section. It will be necessary for our members or member companies to pay for any copies they may get, and possibly that can be done through this Association as soon as the book is ready. Mr. Rypinski says: "It is hoped that they will be able to distribute a great many, and the cost to the members will be nominal. I believe the handbook will be so valuable that the member companies will gladly purchase a quantity of them for the use of their solicitors, contract agents and consumers."

QUESTION BOX

M. S. SEELMAN, Jr., *Editor* . . . . 360 Pearl Street, Brooklyn, N. Y.

All correspondence relating to the Question Box should be sent to the Editor at above address.

Replies, to prove of maximum service, should be forwarded as soon after receipt of Bulletin as possible.

Where limitations of space prevent their publication, replies will be forwarded to propounder of inquiry.

The Question Box is conducted by the Association in order to supply prompt information to member companies, and as a clearing-house of problems and practise in every department of central station activity. The more freely it is used, the more comprehensive and generally useful it becomes.

The assistance of every member is requested in order that this department may prove of the utmost value to all.

CONTENTS

EDITORIALS

QUESTION BOX CLASSIFICATION

"ICH DIEN"

Among the contributors to this month's *Question Box* are many names known throughout the length and breadth of the land and beyond.

As indicative of the standing of the *Question Box* and its recognized importance as a means for disseminating central-station information and experiences, these three are specially significant:—Dr. Elihu Thomson, Dr. Edward Weston, Dr. Charles P. Steinmetz.

Dr. Thomson direct, and Dr. Weston through his secretary, respond to an inquiry concerning meters, while Dr. Steinmetz gives some advice to a young man anxious to gain sufficient knowledge of the technical side of our business to fit him for the management of a small central station.

The fact that men of this standing and calibre are willing to respond to the call of the *Question Box* and give freely of their knowledge and experience, furnishes both example and encouragement. It adds fresh prestige and dignity and helps to popularize this disinterested but mutually beneficent service. "Ich dien," is, after all, the expression of and underlies an exalted conception.

"NEIGHBORHOOD" PUBLICITY

Question 21—32 reads as follows:

"What policies do companies pursue in the matter of advertising in programs and miscellaneous publications of churches, schools, social and political organizations and the like? Do you consider this type of publicity to have any actual advertising value? Do you consider it worth while to spend a certain amount of money in this way, for the sake of the good-will so gained, or not? Would like to have the practise and opinion of as many companies as possible."

Many men, many minds. The large majority of replies to this inquiry, however, are of the same tenor, and are epitomized in the following reply from Mr. Pembleton, of Newark:

"We do not advertise in programs and miscellaneous publications of churches, schools, social and political organizations, etc. We do not believe that this form of publicity produces any real results. We do not spend any money for this form of advertising. We depend upon reliable and efficient service to retain the good-will of our customers and the general public."

Practically all the large companies agree with this view of the case. Two or three spend money on this type of publicity, "when there is some special reason for doing so." Glenn Marston, who has had considerable experience in fighting municipal ownership in different cities and towns, says he uses program advertising as a matter of policy when the company is subject to agitations of any specific character, but even he does not believe that such publicity is justifiable from a purely commercial standpoint.

This does not seem to us to be a good argument, for, if program advertising is advisable "as a matter of policy" during "agitations," it is logical to

believe that it would be still more advisable as an aid in forestalling such hostile movements. Prevention is usually deemed preferable to cure, and if there is any truth in the idea that the good-will of the community is a necessary foundation for a permanently profitable and satisfactory business, and good-will is to be gained, at least in part, by this kind of advertising, then it must be profitable commercially.

The only exception to the consensus of condemnation is a reply from K. G. Martin, of New York, who, so far as we know, has had little advertising experience, but whose reply indicates that he thinks for himself and has ideas, and plausible ones, of his own. The advertising manager of the Chicago company considers such advertising as "charity," but does admit that this form of publicity "oftentimes results in more friendly relations between company and consumer and between company and various organizations," and that "value is usually received, if not directly, indirectly."

To this practical unanimity of condemnation the editor of the *Question Box* is regretfully impelled to dissent. After long experience he has come to the opposite conclusion and is absolutely clear in the conviction that, used with discrimination and judgment, this kind of advertising is not only defensible from the standpoint of policy, and potent in securing good-will, but can be made commercially profitable.

Why should not the members of a local church organization, for instance, with 150 or 200 members, read the advertising in a program of one of their activities and be affected thereby? Do they not sustain an intimate relation to such publication, and, if so, why should they not be really interested in attractive announcements contained therein? Why should not a number of members of such organization feel grateful for the consideration afforded them? In newspaper advertising only a small percentage of readers will be interested or affected or even see our advertising. The proportion in a good publication of a neighborhood organization is probably much higher, while the cost is, all things considered, lower.

Eliminate as far as possible the "strikes," which, strange to say, are frequently successful bidders for advertising from central stations where meritorious neighborhood propositions fail, treat the neighborhood organizations liberally, but with a proper understanding of relative values, use the right kind of copy, and excellent results in proportion to expenditure are certain to accrue in good-will and actual business done.

The appropriation required is comparatively small. Two or three thousand dollars a year will buy an immense amount of what may be termed neighborhood publicity, in a large city, while in smaller cities the expenditure will be proportionately less.

Of course it is always possible to do a favor in such clumsy fashion as to make an enemy, but every central-station advertising manager worth his salt has tact and address, and by handling this neighborhood publicity aright many

good friends may be made, whose kindly feeling toward the company will be a real asset and may prove invaluable in emergency or time of trouble. Far from being "charity," we consider that this is real good business.

We know the statement of such a conviction is rank heresy. We felt the other way for many years. It is a fetish or superstition of the business. Nor do we believe such advertising would necessarily prove profitable for ordinary mercantile or manufacturing enterprises. But for a central station the case is different and we are satisfied that neighborhood publicity can be used by us, to a far greater extent than at present, to most excellent advantage.

WHO SHALL JUDGE?

The Salesmen's Record Card supplied by the General Electric Company and reproduced in this issue in a reply to question 24—57 seems to be an excellent method of obtaining and registering information such as central stations customarily secure from applicants for employment, and also for keeping a line on the salesman's experience and achievement after he is put to work.

One feature of the card as reproduced, however, seems singularly inappropriate. Spaces to be filled out are left for "Personality ...." and for "Dominant Characteristic ...."

"Personality?" "Dominant Characteristic?" Mouth filling and impressive, but—Quien Sabe? We had supposed that only the fortune tellers, the sensational novelists and the Almighty could accurately measure such qualities as these.

Why attempt to make psychologists of department heads or other employers of labor? Why include such indefinite and indeterminate analyses?

What is or can be gained thereby, except to add an element of the ridiculous to what would otherwise be a commendable business method?

EXTENSIONS

The subject of question 24—67 is a very interesting and important one. It treats of the basis on which companies make extensions arising in the ordinary course of business, and asks particularly what percentage of first year revenue to cost is required before making such extensions without charge to the customer.

Most of the replies indicate that the average large company requires a guarantee of 50 per cent of the cost, in annual revenue, as a prerequisite to the making of any except what might be termed trunk line extensions. In other words, the cost of the extension must be paid for within two years. In one large city estimated yearly revenue must equal entire expense of constructing the line. In another city, however, only 20 per cent of the cost of the construction is required, while an entirely different policy is indicated in the following statement of the sales manager of the Detroit company: "We make all extensions without cost to the customer, and if the request for extension is in a growing neighborhood, we always meet the demand."

We realize that there are extensions frequently demanded of central stations which are unreasonable to ask and would be unprofitable to make; also that extensions are too expensive in the average large city to be made indiscriminately.

Nevertheless, is not this subject of extensions one that should receive more co-ordinate consideration than it so far seems to have received? Is it not a subject to be thrashed out at a Convention of one of the two great central station organizations?

The matter is one difficult, if not impossible, to standardize, on account of widely differing conditions, but something might ensue from general consideration, which by consensus would put us all clearer as to what constitutes, all things considered, a reasonable basis for making extensions, and which might tend to prevent hostile legislation or at least hostile public opinion.

Are we in general too stiff in regard to extensions and do we insist on too large a measure of self-protection, or not? That is the question and it is one to be decided by figures and not by arguments. Let us tabulate costs and returns from the class of extensions under consideration, and find out whether they have been more or less profitable than we mentally estimate, and then let us compare. Let us find out if the company which has been most liberal or the company which has been most stringent, can show the best all-round results. In this way we could ascertain if present practise is right and reasonable, or the figures would indicate whether we should "tighten" or "loosen" up.

FROM BROOKLYN TO CHICAGO

The centre of *Question Box* activity will now shift with the succession of executives from Brooklyn to Chicago. Chicago is the expression and embodiment of the superlative in achievement and anything undertaken under Commonwealth auspices is certain to be accomplished with individuality, intelligent direction, energy and effect. In other and simpler words, the Chicago organization generally hits the bulls-eye.

The editor of the *Question Box* (who will soon be the late editor) knows that his successor, Mr. E. A. Edkins, will receive the same full measure of unselfish assistance and cordial co-operation that has been accorded the present incumbent. This is characteristic of the Association and the industry and is one reason of our phenomenal growth. We all pull together.

Mr. Edkins has made a hit as chairman of the Editorial Committee of the Commonwealth Edison Branch, N. E. L. A., publishers of "The Edison Round Table," and in that capacity has indicated that he is especially well equipped to carry on the national work to which he has now been called. We expect great things from him.

The present editor stills his editorial tongue and lays down his editorial pencil with mingled feelings of regret and relief. It has meant much work but was in the main enjoyable and we are sure not unproductive. The usefulness of the *Question Box* as a function of the Association is generally recognized. Its importance cannot be exaggerated. Its future is practically assured. It only remains then once more to express personal appreciation for help received from many sources, and to wish God Speed to our successor.

Long may the *Question Box* continue its useful career, and good luck to its new Editor!

And so—until we meet again!

ANSWERS

BOILERS, ENGINES, TURBINES

4—4. On what slope (minimum) will slack coal run? Does slope vary for open or closed chutes?

(Also answered in June BULLETIN.)

Alex Dow, Detroit, Mich.—Slack coal, very dry, will slide on 40 degrees slope. Slack coal, damp, will stand vertically. Between dry and damp conditions of any kind of slack coal, and between coal which is coarse and coal which is nearly all dust, the variations are so great that the only way to predict what any run of coal will do is to try first and do the predicting afterwards.

A closed chute requires more slope than an open one. Likewise it is much more troublesome to break a jam in a closed chute than in an open. Good practise is to make closed chutes as nearly vertical as possible.

Kingsley Gould Martin, New York City.—As already indicated, the angle of coal slides and chutes, if expected to operate entirely by gravity action, should never be less than 25 or 30 degrees, even with the most favorable grades, and the steeper the angle the more satisfactory will be the action and delivery of the coal, and even under the best conditions coal has occasionally stuck in the usual rectangular chutes at fairly high angles when supplies have not been constantly drawn, and as it nearly always binds near the lower end, it would seem to be due to pressure and perhaps to a too sudden stoppage of the coal stream, incurring a tendency to jam.

It is presumed the question refers to relatively small metallic chutes and in this type the closed chute is perhaps preferable, for an open low angle chute is almost as liable to interruption of supply from such sources as rough or defective surfaces, foreign binding matter, etc., as the same angle of closed chute and the chute itself is not always easy of access so that the jam can be broken by prodding.

With a high angle open chute, the coal, if being delivered at anywhere near the capacity of the chute, will tend to spill over and keep running if not carefully shut off, and such an occurrence taking place at some higher point in the line might prove most inconvenient. An approved system controlling simultaneously both ends of the chute is therefore desirable.

The coal stream is most easily started in both types, if it sticks, by vibrating the chute heavily at definite intervals. Continuous light vibration will only make matters worse, as may be appreciated, since there is quite apt to be present at all times such natural vibration.

In the designing of a dumping motor truck it has been found that the minimum angle at which practically all loose and semi-liquid material, such as coal, trap-rock, sand, mortar, etc., will slide, is less in the case of trucks in which the entire load-carrying body is raised than the angle which has to be used in a body which is stationary and is unloaded by opening gates at the low points.

This is probably explained by the fact that the operation of the raising type is not affected by the packing of the material by vibration and weight during haulage, since the entire mechanical structure of the load affecting its tendency to slide is altered when the platform is tilted.

6—6. We have a 500-kilowatt unit of some kind to install and are endeavoring to obtain data to determine whether to install a compound-condensing, direct-connected engine outfit, or a steam turbine (A.-C. system). Would like to know from actual experience which is considered the better proposition. Any data you can furnish along these lines will be greatly appreciated. While I consider an 1800-r.p.m. turbine of the larger sizes good practise, I am doubtful about the 500-kilowatt, 3600-r.p.m.

Eastern Michigan Edison Company, Detroit, Mich.—We have had to decide, in two of our suburban power-houses, between direct connected engines and

small steam turbines. We decided in favor of the turbines, and installed in one power-house a 750-kw, 1800-r.p.m. horizontal condensing turbine, which we followed up with another a year later. In the other power-house we installed a 500-kw, 3600-r.p.m. turbine complete with service condenser and dry air pump. We are very well pleased both with the cost of these equipments and their running. We think the 500-kw, 3600-r.p.m. machine is all right.

H. P. Wood, Operating Engineer, Edison Electric Illuminating Company of Brooklyn.—There are several 500-kw, 3600-r.p.m. turbines in satisfactory operation, giving excellent results.

Geo. S. Blankenhorn, Allis-Chalmers Company, Milwaukee, Wis.—As will be seen from the curves, the steam consumption of a steam turbine and a

Corliss engine of 500-kw capacity, respectively, are not far apart on or close to normal load, while at light loads the turbine has the better of it. I have

assumed the same steam conditions in each case, with the exception of the vacuum. This was taken at 28 inches for the turbine and 26 inches for the engine, as in the best practise of to-day this vacuum corresponds respectively with what is commonly used with these two types of engines. Local conditions alone must determine which type of engine will be most satisfactory. For instance, a turbine uses no cylinder oil, which not only means a saving, but this steam may be used for any of the many processes where steam with oil in it could not. The turbine will take considerably less work to keep up than the engine, although the high vacuum condenser will take more. Lack of floor space is always a good excuse to install a tubine, especially since the modern turbine condenser is placed directly under the foundation, thus doing away with the former prejudice, although considerably in error, viz., that the turbine condenser made up in size for the difference in size between the engine and turbine. In localities where it is impossible to get a good foundation, as in swampy land, the turbine is to be greatly favored. A slug of water from the boilers will not hurt the turbine, it simply slowing down until it works the water out. As regards the question of speed, the fact that turbines of 500-kw capacity running 3600 revolutions per minute have been built in this country for a period of seven years by several of the largest manufacturers, who are now building machines of very much greater capacity at that speed, certainly shows that no trouble should be anticipated from this cause.

The Corliss engine is the engine to select, if for a considerable part of the time the unit is to be run noncondensing, as in plants where steam is used in the winter for heating. If a 26-inch or lower vacuum is all that can be obtained the year around, owing to warm condensing water, from the coal pile point of view, put in an engine. The engine also has the advantage that in isolated plants where labor is hard to get, the men who are available for this class of work undoubtedly are familiar with the Corliss and its peculiarities.

Edwin D. Dreyfus, Commercial Engineer, The Westinghouse Machine Company, East Pittsburgh, Pa.—When accurate results are compared, turbines of

this size are superior in economy to the engine, and in the present day of progress there can hardly remain any doubt of the advisability of installing the *turbine.*

Searching for some of the highest records attained by the usual design of Compound Corliss Engines, we find about the best result reported by Doctor D. S. Jacobus, in the 1903 proceedings of the American Society of Mechanical Engineers on Tests of a Unit of Approximately 500-kw Capacity. For the turbine performance, government tests on a 500-kw unit operating at 150 pounds gauge pressure, 100 degrees superheat and at 28 inches vacuum, is given in Curve "A." The engine economy reduced to the kilowatt basis by taking established mechanical and electrical efficiencies and also corrected to the turbine conditions is represented by Curve "B." The improved turbines naturally sustained their efficiency over an almost indefinite period, while the engine's is liable to decline due to inadjustment and leakage of valves, pistons, etc., and, therefore, requires very much more attention to maintain it at a point of best efficiency. Hence, the average engine steam consumption to be expected in regular operation is shown by curve "C." There has been so much already said on the subject of decreased oil consumption, attendance, floor space, steam consumption and maintenance wrought by the turbine, it becomes repetition to dwell upon the subject. Regarding rotative speeds, it will be found that the increased speed rating is a step in the right direction. Smaller diameter accordingly and greater homogeneity of metal is thereby secured, which insures the integrity of the apparatus.

There are over 500 turbines of 500-kw capacity operating at 3600 r.p.m. in this country. Several turbines of 2500-kw capacity, of the same speed, have also been placed in service. There will be no difficulty in finding an abundant amount of information along this line on record.

GENERATORS, CONVERTERS, SWITCHBOARDS INSTRUMENTS

10—48. It is desired to supply 110-220-volt electrical energy for lighting from one generator. Under what conditions should

1. A 3-wire generator be used?

2. A 2-wire generator and a balancer set?

(Other replies in June BULLETIN.)

E. F. Bracken, General Inspector, Substations, Commonwealth Edison Company, Chicago, Ill.—A three-wire generator may be used in installations where the two sides of the three-wire system are loaded about equally in current and the balance is not greatly disturbed. A two-wire generator with a balancer set, if of sufficient capacity, would be preferable in installations where the balance is expected to be frequently disturbed or the load on one side is considerably heavier than on the other.

10—49. We have a 225-kilowatt, 2300-volt, 60-cycle, 2-phase, revolving-field Walker alternator, direct-connected to a four-valve, tandem-compound engine. After running this generator ten or twelve hours, it begins to lag and refuses to carry over two-thirds of its rated capacity, and after running 24 hours, will not carry more than one-half its capacity. It does not get excessively hot, and the exciter maintains its average at all times. We wish to know if any member can advise us the cause of this trouble, and how it can be remedied, and if shortening the air-gap will have any effect on this.

H. P. Wood, Operating Engineer, Edison Electric Illuminating Company of Brooklyn.—It is evident from the question that the fields have been checked at the beginning and end of a 24-hour run, and if this check does not show that it is field trouble the only other condition would be in the regulation of the engine. If it is due to the field getting too hot, shortening the air gap would benefit by being able to carry the load with less field excitation.

11—21. What has been the experience of member companies regarding the uses of varnished cambric for insulating high-tension cables?

What voltage do you use it on?

What is the temperature of the air where it is used?

How many years have you had it in service?

Do you cover it with lead or with braid?

Have you ever had any trouble with varnished cambric cable?

How does it compare in durability with good rubber when exposed to the same conditions of load and external temperature for the same number of years?

(Other answers in June BULLETIN.)

H. L. Wallace, Engineering Department, The Cleveland Electric Illuminating Company, Cleveland, O.—We use cambric tape on 2300 and 11,000 volt cables. It is impossible to apply varnished cambric when the temperature is very much below the freezing point, owing to brittleness. Maximum temperature surrounding air about 120 degrees F. In service about five years. We cover it with black adhesive tape and insulating paint when used on joints. We have had no trouble with it and notice no deterioration. Our varnished cambric cables are covered with asbestos and braid, but we have not used any lead covered cambric cables.

OVERHEAD AND UNDERGROUND LINES

12—47. If all the station output of single-phase, 2300-volt, 60-cycle current for incandescent lighting is metered at the station and all the customers are on meters, in a town of 5000, what proportion exists in actual practise between the total consumption as indicated by the customers' meters and the total output of the station as indicated by the station meter? In general, what per cent of the loss is chargeable to line, transformers, meters—what else?

(Other replies in May and June BULLETINS.)

Charles A. Stanley, Industrial Engineer, Kansas City Electric Light Company, Kansas City, Mo.—A central station having generator capacity of 750 kw with 600-kw peak load and 350-kw average load, the greater part of the day load being single-phase motors in small industries, proved to have a loss of 29 per cent between central station and customers, divided as follows:

Lines	14%
Transformers	10%
Meters and other losses	5%

Another station of 150-kw capacity operating on a night schedule only, with 150-kw peak load and 50-kw average load, shows a loss between station and customers of 20 per cent, divided as follows:

Lines	10%
Transformers	6½%
Meters and other losses	3½%

In this case it should be understood that the copper was much larger than needed, resulting in low line loss and that transformation was obtained by means of a few large transformers rather than a large number of small ones, which was possible, due to the greater part of business being in the central part of town.

12—49. Do member companies find it practicable to have linemen's hatchets equipped with a leather thong or rope to slip over lineman's wrist while he is using hatchet at work on pole above ground, in order to prevent injury to persons on ground should hatchet slip from his hand?

(Other answers in May and June BULLETIN.)

A. O. Brandt, Superintendent Electric Distribution, Oakland District, Pacific Gas and Electric Company, Oakland, Cal.—We do not consider it practicable to equip linemen's hatchets with leather thongs. There is but little more probability of linemen dropping a hatchet than there is of dropping a monkey wrench, or a lag wrench, or a pin and insulator. Thongs or ropes attached to such tools would handicap the linemen's work. We have had no such accident as the question suggests, in the history of the Oakland Gas, Light and Heat Company.

12—52. Do any member companies give their linemen's rubber gloves any test before issuing them for service? Do any buy linemen's rubber gloves under any specification, and if so, would like to know what points are covered?

(Other replies in June BULLETIN.)

William A. Durgin, Assistant to Chief Testing Engineer, Commonwealth Edison Company, Chicago, Ill.—Each glove used by this company is tested for dielectric strength and insulation when received from the manufacturer by filling it with water to within one inch of the wrist edge, immersing in a tank of water to the corresponding depth and applying 60-cycle sine wave pressure between the inner and outer water surfaces for one minute. Gloves for use on 4000-volt system are tested at 4000 volts, and those for use on the 9000-volt system at 10,000 volts. Orders for gloves contain the clause "Guaranteed to withstand a breakdown test of 10,000 (or 4000) volts."

No specification is made of such characteristics as electricity and mechanical strength, but frequent service tests are made of new makes of gloves, and only those showing the best quality are ordered.

W. A. Hudson, Boston, Mass.—The practise of testing all linemen's gloves before issuing them for service has been carried on for a number of years. Each glove is subjected first to a careful inspection for any mechanical defect, and then tested at 6500 volts alternating-current.

Recently, this specification has been changed, requiring a guarantee of 10,000 volts, the test now being made at approximately 9500 volts. This gives a good margin of safety, since the company does not require the men to work on live lines carrying over 4000 volts.

Thomas Sproule, Philadelphia Electric Company, Philadelphia, Pa.—This company does not buy rubber gloves under any specification, nor does it subject them to any test. The gloves purchased are the result of a careful study as to the wearing qualities of various types of rubber gloves on the market and it was found that the Goodyear A No. 1 white acid-proof glove, reinforced on fingers and palms of the hands, with a five-inch gauntlet, were the most satisfactory. This glove has been used for a number of years and little or no complaint has been received from the linemen. It is our practise to exchange gloves for the linemen at any time, and they naturally watch them very carefully. I know of no specifications covering linemen's rubber gloves.

Kingsley Gould Martin, New York City.—The testing and subsequent distribution of rubber gloves under service conditions has not received the full attention which such matters deserve, especially when we consider that upon the presence of a minute flaw may depend the lives of those operating under our direction. Gloves need not be ordered under any other specification than that they should withstand a certain potential, when dealing with recognized manufacturers of the best grade of supplies, unless something very special is desired, as such makers fully appreciate from experience and engineering knowledge the necessary qualities that a perfect glove should possess, and will not jeopardize their position by offering inferior goods.

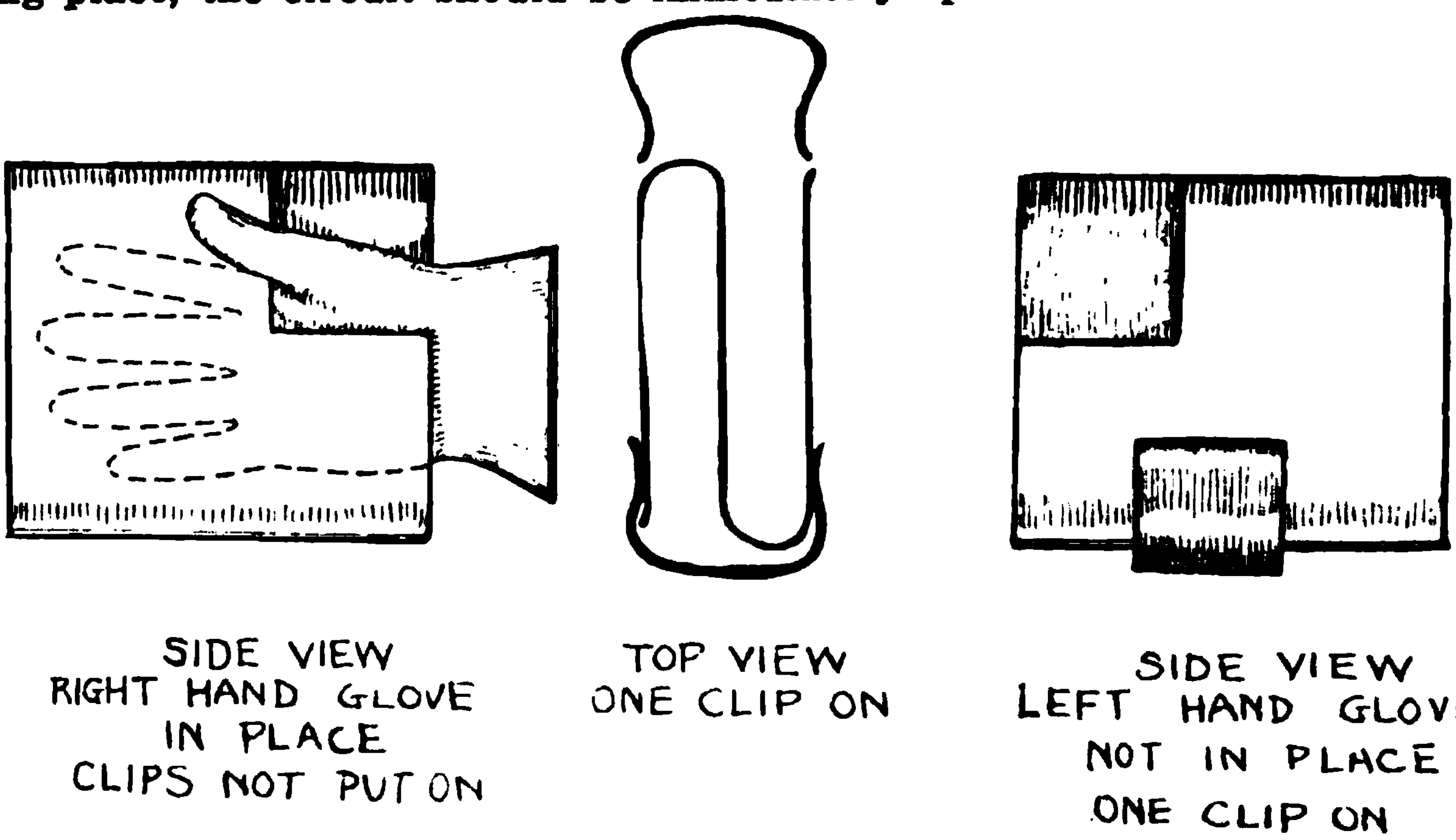
Upon receipt of the gloves they should be unpacked and assorted in boxes according to the potential requirements. They should then be inspected in pairs for mechanical defects, such as cracks, parted seams, interior roughness, etc. Gloves for potentials of about 2000 volts are generally lined with canvas, as the thickness of rubber for insulation purposes would not give them sufficient body. This type of glove should receive a greater amount of attention than the moulded pure-gum mitt, as it is more apt to prove defective. The gloves are frequently fastened together at the wrist or gauntlet end by a stitch or two, and they should always be cut apart and not violently broken, as this will start a crack or tear detrimental to the entire fabric.

There should be provided a testing holder made as per sketch, of a piece of heavy tin into which should be slipped a pair of gloves, and the tin clips applied. Copper shot should then be poured into the gloves to within one-half inch of the top. Lead shot will soil the gloves and coat them with metal; aluminum cannot be used successfully in the presence of the salt solution. and water should never be put into the gloves, as it is difficult to dry them at best and considerable time is consumed; while if they are packed wet they will deteriorate rapidly.

The holder should be lightly tapped in order to distribute the shot evenly

and into the finger-tips, and then placed in a tin bucket or small tank filled with a saturated solution of common salt. Should any tipping of the holder be feared, a couple of wooden slats may be secured across the top of the pail to act as guides. One side of the transformer testing bank may then be made alive to the tank and the other side to the shot in the gloves by bare copper wire of sufficient rigidity. The water level should be within one inch of the wrist or gauntlet end of the glove.

The required potential should then be impressed and continued for the desired interval. Readings can be conveniently taken by stop watch and a volt meter across the primary, with a known ratio of transformation. The modern tendency is to reduce the time of test with an increase in voltage imposed, it being thought that this better simulates actual operating conditions. In general, the voltage of the lines on which the gloves are to be used should be continued for not less than three minutes, practically all defects becoming apparent within this critical period; an increase in voltage of from 100 per cent to 200 per cent should then be carried for one minute. Upon a puncture taking place, the circuit should be immediately opened and the defective glove



removed in order to avoid wetting the copper shot. Accurate record should be kept of duration, voltage, etc., of test and of the point of rupture, as several gloves of a certain make will often fail in the same place.

All gloves passed on first or subsequent tests should be stamped with the date, normal service voltage, and intials of tester, and should be periodically retested even when not used. Gloves should be used by one lineman but once between tests, as he may use his tools in such a manner as to injure the glove, or it may be pierced by a fine strand of flexible cable or burnt by a spatter of solder. Used gloves should be thoroughly dried inside before retest for putting back in stock. Mitts may be turned inside out and gloves may be dried by suspending fingers up from a line by spring-clip clothes-pins, preferably over a steam radiator or small electric grid.

A fairly well-fitting glove will last much longer than one too large or too small, besides affording a greater degree of safety to the workman, and several sizes should therefore be carried.

Thanks are due to Mr. C. G. Kilbourne, of the New York Edison Company, for assistance in answering this question.

12—53. We make periodic inspection of all lightning arresters on our distribution system. To get a record of the performance of the arresters and spark-gaps, we insert prepared slips of paper within the spark-gap. We would like information from member companies as to methods pursued in making periodic inspections. Is specially prepared paper used for this purpose? How is it prepared? In testing the resistance of the ground connection to the pipes of water or gas system, what method and apparatus are used, and what is the maximum resistance permissible?

W. M. Ryerson, General Manager, Great Northern Power Company, Duluth.

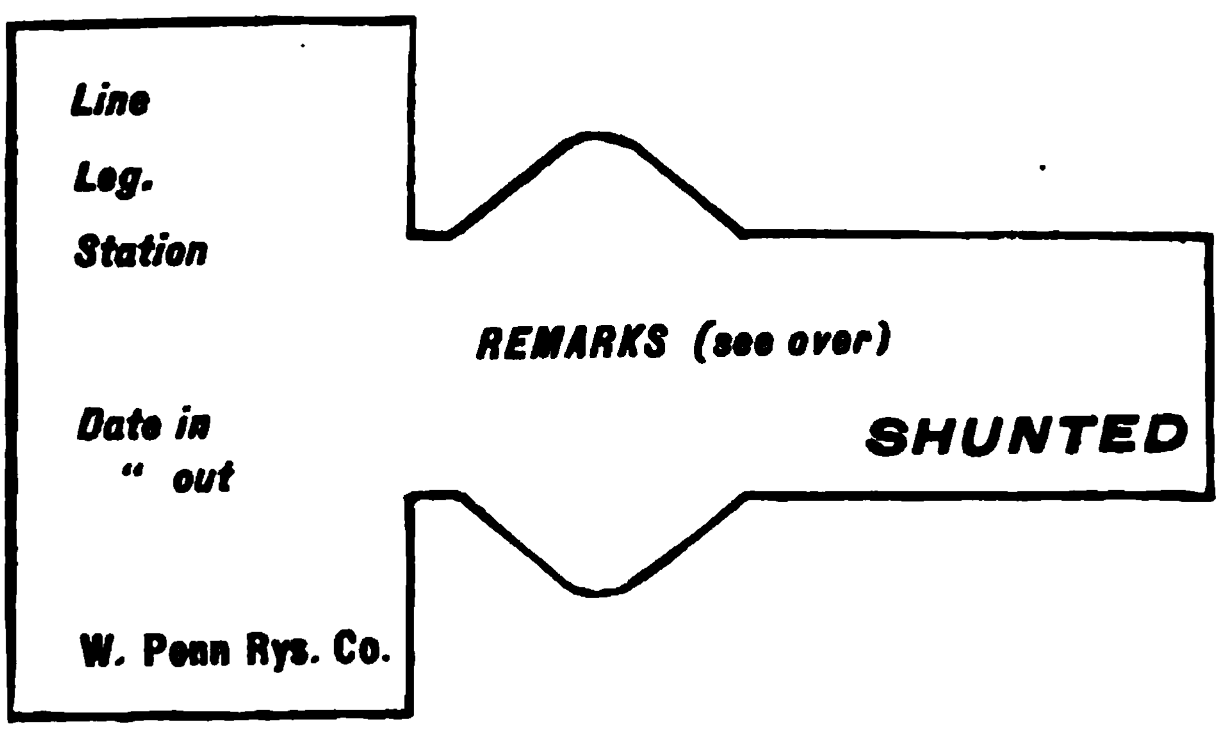
Minn.—All the lightning arresters belonging to this company are either in the power station or distributing stations, where they are easily inspected. We make it a practise to keep test papers in all lightning arresters throughout the year, but, of course, make more frequent inspections during the lightning season than during the remainder of the year.

This past winter we have installed the so-called automatic discharge recorder at both ends of our high-tension transmission lines. This device consists of a clock movement driving a sheet of paper similar to that used in curve drawing instruments, and this paper is punctured by discharges between phases of the lines or from any phase to ground, the markings on the paper indicating the time of the discharge and what path it took. A little experience in the matter of the use of test papers, together with observations taken by the operating force as to the severity of the lightning, gives a good indication of its behavior with regard to the system, and we have found it extremely useful to keep a careful record of all lightning disturbances on our system, and this applies as well to the 13,200-volt distributing circuits as to the 33,000-volt transmission line.

The test papers used in the so-called multi-gap arresters are folded in such a way as to present two thicknesses of ordinary writing paper to the path of the discharge, and are shaped so that they can be inserted and removed from the arrester by means of an insulated handle without cutting the arrester out of circuits.

These small test papers, as well as sections of the recording tapes, are pasted in a book with complete remarks as to the particular lightning storms, and its effects on the system in general.

R. P. Jackson, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.—A periodic inspection of lightning arresters was of more importance on the older, low equivalent or multi-gap type, than on the more recent electrolytic type, as the latter have to be charged and inspected daily in order to keep them in good condition. Inspection of the multi-gap arresters usually consisted of cleaning out the cylinders, looking over the resistance to see that they were intact, and putting in tell-tale papers. For the low equivalent arrester these papers consisted of small double sheets so arranged as to slip in between the cylinders. The papers were not prepared in any way except as to shape and color and were not fire-proof. A puncture, of course, indicated that a discharge had passed and the nature of the puncture indicated



the nature of the discharge. A large, ragged, unburned puncture indicated a free static discharge. A small burned hole indicated a slow and probably a power discharge. Some of these papers are enclosed in this letter.

As to the testing for ground connection, would say that this is rather difficult unless there is near by a good ground, such as a water-pipe system, which may be assumed to have zero resistance. The value of these two grounds in series may then be measured with current large enough to get a good reading. If there is no such water-pipe system, two grounds in series may be measured, but there is no way to determine the individual value of each. By measuring

a pair of two out of three grounds in succession, one may get the value of each, but this is an unusual condition to have. It is rather difficult to get a ground plate to have less than 50 ohms resistance unless a large area and very moist, salty earth. A large part of a ground resistance, however, is local and a number of smaller grounds, some distance apart, give better results. In general, it is desirable to get resistance values less than 50 ohms for most purposes, and for grounding a neutral of generating systems the resistance should be very low as a rule and of a known value just sufficient to permit the tripping of the highest set circuit-breaker on the system.

H. B. Gear, Engineer of Distribution, Commonwealth Edison Company, Chicago, Ill.—It is the practise of this company to make periodic inspections of all lightning arresters in the Spring of the year with a view to ascertaining their general condition. We have only used prepared paper for securing records in cases where it was desired to get information as to the performance of lightning arresters under special conditions. A paper specially prepared for this purpose by the General Electric Company was used.

In measuring the resistance of ground connections it has been found convenient to use a section of an automobile storage battery with a voltage of 15 to 25, short circuiting it directly from the ground wire to the nearest water pipe, using sufficiently heavy leads so that the drop in the conductors would be negligible, usually No. 4 wire. Resistances of ground connections should be below 50 ohms if possible.

B. E. Morrow, Albany, N. Y.—In our multigap type of arresters we use telltale papers made of ordinary bond paper, upon which is stamped an outline of the information desired, as shown in the report of the Committee on Protection from Lightning, 1910, form "B." We have not used treated papers at all, but they may be made non-combustible by immersing in a concentrated solution of sodium tungstate and dried. Inspections of these papers are made after each lightning storm or circuit disturbance, and also at least once a week whether a disturbance occurs or not.

In testing the resistance of the arrester grounds, the ordinary voltmeter-ammeter method of measuring resistance is employed, and at least three separate grounds are required. The resistance of two grounds in series are measured, and after the resistance of all the possible combinations have been measured by elimination, the resistance of each individual ground is obtained. Where less than three grounds are normally in use, a temporary ground is secured for the test by the use of an iron bar, or any other convenient ground connection.

The resistance of an arrester ground varies considerably in different localities. A large majority of our grounds measured from less than unity to 18 ohms. Although, in some cases a higher resistance than this is in use, a ground having such a high resistance is always in multiple with an additional ground having a lower resistance. We believe a resistance of 15 ohms or less is entirely satisfactory, provided the surface of the ground connection is adequate.

12—54. What experiences have member companies had with the ordinary portable testing sets, connected up for the Murray loop test in locating faults in power cables?

Wm. A. Durgin, Testing Department, Commonwealth Edison Company, Chicago, Ill.—The Murray loop test is applied most accurately when the resistance of the loop in the testing apparatus is approximately equal to the resistance of the cable loop. As most power cables have a resistance of but a few ohms, this condition cannot be realized in the ordinary portable testing set, and as a result the Murray loop tests, made with such sets, give only approximate locations. A simple "slide wire" bridge having a resistance of about one ohm is much more satisfactory, giving locations correct to the nearest manhole. Several convenient forms of this latter apparatus are in the market.

12—57. We wish to inquire if any member companies have had experience in repairing the decayed butts of wooden poles by the use of reinforced concrete? If so, has this proven a successful method of preventing any further

decay? Please give all the information available concerning the subject of repairing the decayed butts of poles, whether with concrete or any other method.

J. W. Lafferty, Superintendent Distribution, Edison Electric Illuminating Company of Brooklyn.—About two years ago we repaired several poles by reinforcing the decayed bases with concrete. These poles are still standing up, but I do not know the condition of the interior of the poles.

This is the only method we have used and I am not prepared to say that it is a practical method, as the cost is rather high compared with that of a new pole. Another objection is the unsightly appearance on account of increasing the diameter of the base of the pole, at the sidewalk level. The concrete reinforcing extends 24 inches above the sidewalk and the diameter is increased 12 inches; for instance, a pole 20 inches in diameter extends for two feet above the sidewalk, with 32 inches diameter.

This is objectionable; in fact, it looks as if the pole had been planted in a barrel.

R. D. Coombs, New York.—I think that undoubtedly it will prolong the service of a decayed pole to cut away the decayed wood and to surround the butt above and below the ground line with an envelope of reinforced concrete. This is probably a good method of prolonging the usefulness of an existing line, but it would be more economical to creosote new installations.

F. C. Sargent, Engineering Manager, Malden Electric Company, Boston, Mass.—We have been experimenting for some time with the methods patented by the Pittsburgh Reinforcing Pole Company, Pittsburgh, Pa., and from such results as we have obtained thus far, we have come to the conclusion that this is a successful method and an economical one to use. We expect to do a large amount of this work the present year.

13—24. What rules are member companies pursuing in regard to bending of high-tension, lead-covered cables, and approximately what proportion of cable faults occur at bend?

(Other replies in June BULLETIN.)

D. W. Roper, Assistant to Chief Operating Engineer, Commonwealth Edison Company, Chicago, Ill.—This company has adopted 20 inches as the minimum radius of bends for three-conductor transmission lines of No. 2/0 B. and S. and larger. For No. 0 B. and S. four-conductor cable the minimum radius is 18 inches. For smaller cable the minimum radius is 10 inches. It is important that bends of a smaller radius should not be made while installing or training the cable if best results are to be secured. During the past few years, in a period in which we have had 115 burn-outs, only two have occurred in the bend in manholes.

13—26. Have any definite figures been obtained, showing the comparison of life between the new fibre conduit used in underground construction and the old iron-pipe conduit?

The Fibre Conduit Company, Orangeburg, N. Y.—We have fibre that has been in the ground for eighteen years and it shows no deterioration whatsoever. We think that you will find that the average life of wrought iron pipe in the ground, unprotected, is about fifteen years.

TRANSFORMERS, STORAGE BATTERIES, ETC.

14—8. Have any of the member companies purchased Gould storage batteries? If so, what capacity, and are they for peak or stand-by service?

(Other replies in June BULLETIN.)

George C. Holberton, General Manager, San Francisco Gas and Electric Company, San Francisco, Cal.—This company has purchased a battery from the Gould Storage Battery Company, and the same is just about to be placed in operation, so that at this time I am not able to give you any information of value, except that the cost of same per kw capacity was very much lower than the price formerly paid by us, sufficiently low, in fact, as to justify us in its purchase, and we have every reason to believe that its operation will be satisfactory. The battery purchased by this company is of the quick discharge type, and intended for stand-by purposes.

15—57. In a transformer station with two step-down transformer banks, one 1200 kilowatts capacity and one 400 kilowatts capacity, Westinghouse oil-cooled transformers, connected in parallel on 6600-volt, three-phase, 60-cycle system, using Scott connection, transforming to two-phase, 2200-volt, four-wire:

When banks are tied in together either on 6600-volt end or 2200-volt end, at times we get dips of from 2 to 15 volts on lighting system.

What causes these dips, and can same be remedied?

(Also answered in June BULLETIN.)

E. O. Schweitzer, Chief Testing Engineer, Commonwealth Edison Company, Chicago, Ill.—The "dips" in voltage on the lighting system are produced by the momentary rush of magnetizing current in the incoming transformer. This heavy-current rush affects the regulation of the running transformer and line.

The amount of magnetizing current depends upon the remanent magnetism in the iron of the incoming transformer and the point of the pressure wave at which the switch is closed.

If a synchronous motor or generator is available the trouble can be remedied by allowing the transformer voltage to die down gradually with the machine after disconnecting transformer from line. The machine should not be disconnected from transformer until after it has come to rest.

This method will leave the transformer iron with very little or no remanent magnetism and thus reduce the rush of magnetizing current when closing transformer to line again.

15—58. What experience have member companies had with three-phase transformers? Do the advantages of space, economy and cost more than counterbalance the disadvantage of a complete shut-down in case of trouble?

(Also answered in June BULLETIN.)

Charles A. Stanley, Industrial Engineer, Kansas City Electric Light Company, Kansas City, Mo.—In power installations of 100 kw and over, the use of three single-phase transformers is by far the most satisfactory; making it possible, as in the case of one transformer burning out, to operate the plant on the remaining two transformers until repairs can be made, providing the transformers are not subjected to a severe overload.

In my experience the three-phase transformer is used to the best advantage in underground service, where space is a matter of great importance. Also in cases where the central station operates its power service as a voltage or frequency differing from that of the lighting service, the advantages of space, economy and cost favor the use of the three-phase transformers.

15—59. Would like information from member companies as to experience had in fusing the secondaries of transformers operating in parallel on a three-wire, low-tension distribution system, the transformers being located some distance apart.

L. E. Marshall, Industrial Engineer, Kansas City Electric Light Company, Kansas City, Mo.—The operation of transformers in parallel with fuses on secondary or primary is conducive to very unsatisfactory results, unless used in a substation where an operator is in attendance.

If, for example, three transformers are feeding into a common three-wire secondary and the secondary of each transformer is fused to its capacity, the fuses on account of age and corrosion will in time let loose on some one of the transformers and leave the other transformers to carry the entire load. If the remaining fuses do not blow, the voltage will be low. The cause may not be immediately apparent, and there will be numerous complaints from customers.

The same trouble will be experienced if the transformers are fused on the primary side only.

Should the remaining fuses blow, the trouble man will experience difficulty in replacing the fuses, as the first set of fuses replaced will not carry the load during the time taken to replace the remaining fuses.

The operation of transformers in parallel should be avoided unless it becomes necessary, due to lack of large transformers, to obtain the required capacity, in which case it is most important that transformers of the same size and type should be used. The same primary fuse should serve all transformers with no fuses on the secondary.

15—60. We have just connected a moving-picture show using about 30 amperes at 110 volts; the result is that it makes the lights all over town flicker. What is the remedy?

Would a theatre dimmer do the business? If so, what kind is cheapest and best?

Arthur H. Robbins, The Electric Light and Power Company of Abington and Rockland, Mass.—If the inquirer is operating an alternating-current system, a transformer designed for the purpose should be used. The "Compensare" manufactured by the Fort Wayne Electric Works, Fort Wayne, Ind., will fill the bill. A motor generator set designed for the purpose will probably eliminate the trouble if a direct-current system is being operated.

H. B. Barnes, Electrical Engineer, 308 Commonwealth Building, Denver, Colo.—The flickering noted in the lights connected to a circuit supplying a moving-picture machine is undoubtedly due to the excessive current flowing during the instant the carbons are touching while "striking" or starting the arc. This excessive current may be reduced most conveniently by a series resistance, which will not permit more than 30 to 40 amperes to flow even when the carbons are held together. A resistance of this size and capacity is decidedly bulky, and as a considerable amount of energy is constantly being dissipated as heat while the resistance is in use, such an installation should be made with due regard to the fire risk involved.

Where the moving-picture machine is operated from a D. C. circuit the external resistance suggested is the usual practise on voltages up to 250. Above this a motor-generator set is so much more efficient that its use is very desirable. On lamps operated on alternating current a resistance to carry the current necessary (sometimes as high as 60 amperes) is very bulky and inefficient. There are on the market several devices of the compensator or transformer type for reducing the line voltage to the usual arc voltage of from 30 to 35, which are efficient, compact and absolutely safe. The writer has installed several of the so-called "Compensarcs" made by the Fort Wayne Electric Works of the General Electric Company, with very satisfactory results.

H. K. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—We have experienced the same trouble (only not all over town), which we remedied by placing a separate transformer for the arc in the picture machine. Theatre dimmers are not satisfactory for this purpose. If you want to overcome this trouble from the inside, the following devices will limit flickering to a minimum: Fort Wayne Compensarc, Hallburg Economizer, General Electric Economy Arc, or Powers' Induction Terminals.

LAMPS AND ILLUMINATING ENGINEERING

17—32. On page 87 of the "Solicitors' Handbook" a table of Reflection Coefficients is given. Where would Holophane reflectors stand on this table, if inserted?

(Also answered in May BULLETIN.)

W. A. Dorey, Chief Engineer, Holophane Company, Newark, Ohio.—In view of the several answers which have been submitted to question 17—32 in reference to position which Holophane reflectors would take in the table of reflection co-efficients as given on page 87 of the *Solicitors' Handbook* for May, 1911, we are giving below some general information in this connection which may be of interest to the members of the Association.

In the first place, it is practically impossible to classify or give Holophane prismatic glass reflectors any position in a table of reflection co-efficients similar to the one given. The practical application of such a table of reflection co-efficients is to flat or nearly flat surfaces at relatively great distances from a source of light, such as walls and ceilings. The reflection co-efficient for white cartridge paper is given as 80 per cent, but a deep cone of white cartridge paper placed around a lamp as a reflector would not give 80 per cent efficiency, as efficiency is generally understood, because a great many of the light-rays would be reflected more than once by the paper and the reflection co-efficient would apply to each reflection.

In the second place, it would be very misleading to give reflection co-efficients for any translucent material without studying very carefully the con-

ditions involved. For instance, a reflection co-efficient of 85 to 90 per cent, or possibly higher, could be obtained from a flat or nearly flat piece of Holophane prismatic glass, provided all the light considered struck absolutely normal to the smooth surface and the prisms were of such accuracy as to allow absolutely no transmission. As soon as these conditions are varied, a transmission co-efficient enters, and, in general, the sum of the co-efficients of transmission and reflection will increase slightly over the figures given above. In other words, the total absorption will decrease as the co-efficient of transmission increases. It will be evident, also, that in the case of a flat piece of opal glass the reflection co-efficient will vary with the density of the glass, as will also the co-efficient of transmission. In this case, however, the sum of the co-efficients will increase very rapidly as the co-efficient of transmission increases for a given density of glass.

The term "reflection co-efficient" is therefore as indefinite as the term "efficiency" as it is generally applied to reflectors and globes, for, unless the term is limited definitely, its meaning is vague and liable to be misinterpreted.

28—2. Would like information from member companies in large cities where they are using ornamental iron poles for high-voltage series arc circuits, from underground source of supply, as to what make of pole is used. Would like to have names of such, so that we may correspond with them.

Wm. Rawson Collier, Georgia Railway and Electric Company, Atlanta, Ga.—This company does not use any ornamental iron posts for high-voltage series arc circuits. I do not know of any town in the South following this practise.

28—3. Have any member companies substituted tungsten lamps for arc lamps for street lights in sizes less than 250 and 500 watts, and, if so, what sizes have they used, and have they staggered the placing of the lamps or have they placed them opposite each other? Also what prices have they obtained from the municipalities for the different sized units? Are the citizens pleased with such form of lighting as compared with the former method of lighting by arc lamps?

Wm. Rawson Collier, Georgia Railway and Electric Company, Altanta, Ga.—I known of no company which has substituted tungsten lamps for arc lamps for street lights in sizes less than 250 and 500 watts. In all towns where I have obtained information, the arc lamps that were formerly used for illuminating the streets are still in service, being used to light the cross streets. The only information I have regarding the prices obtained from municipalities on small tungsten lamps for street lighting is incorporated in the report of the Ornamental Street Lighting Committee to the New York Convention.

ELECTRIC COOKING AND HEATING APPARATUS

18—6. Wanted:—Information in regard to electric heating devices for incubators.

(Also answered in June BULLETIN.)

Mike S. Hart, General Manager of Consumers Electric Light and Power Company of New Orleans, La.—Mr. Hart sends a letter from Lyman C. Reed, vice-president and manager of the Electric Manufacturing Company of that city, of which the following is an extract.

"The incubators we manufacture are made in a number of stock sizes ranging from 70 to 360 egg capacity and are simply a closed electrically heated chamber thermostatically controlled.

"The heating element consists of a series of coils so wound and arranged as to give an even heat distribution over the entire interior of the machine, and the patented arrangement of the shunted air gap at the contact points on the thermostat keeps them in good shape and enabes an even temperature to be maintained.

"The maximum and minimum amounts of power consumed are as follows:

70-egg	maximum,	50 watts	minimum,	8 watts	average,	20 watts
120 "	"	55 "	"	8 "	"	23 "
200 "	"	70 "	"	8 "	"	30 "
360 "	"	120 "	"	15 "	"	50 "

The above average rates of consumption are based on the machines operating in a temperature of about sixty to sixty-five degrees and would take slightly

more when operating in colder average outside temperatures. On the other hand, a lower average would be reached in warmer climates.

"Central stations all over the country are expressing interest in this incubator."

Mr. Hart states: "I understand that this incubator is proving very successful." Circulars explaining in detail may be had upon request to the manufacturers.

A. U. Brandt, Superintendent Electrical Distribution, Pacific Gas and Electric Company, San Francisco, Cal.—An investigation of the "Electrobator" (by Cyphers Incubator Company) was made in the offices of the Oakland Gas, Light and Heat Company. This is a sixty-egg machine and is heated by an electric heating unit, which is operated by a thermostat. The eggs for the first hatch were purchased at a produce store and only forty-five of them proved fertile, of which twenty-four hatched.

The heating unit in this machine consumes 300 watts at 220 volts. The unit is in circuit about one-twelfth of the time, the total consumption for the hatch being twelve kilowatt hours, or $1.08, at our standard rate of nine cents.

The device is regulated within two degrees, and a standard thermometer placed within the electrobator showed a three-fourths' degree rise above the normal temperature for the apparatus.

METERS

20—81. Would like an expression of opinion from member companies who have used diamond jewels in direct-current meters as to the advantages of the results obtained over the use of sapphire jewels, the difference in price being considered.

(Other replies in June BULLETIN.)

O. J. Bushnell, Superintendent Meter Department, Commonwealth Edison Company, Chicago, Ill.—The average life of diamond jewels has not yet been determined, but there is little question but that it is so long that the use of these jewels in direct-current meters results in maintenance economy, and in addition to this the increased accuracy obtained is alone sufficient to warrant their use in meters showing a considerable consumption.

F. W. Watts, Hazleton District Superintendent, Harwood Electric Company, Hazleton, Pa.—The writer, while connected with one of the large central companies of the country, made some exhaustive tests of the relative benefit of diamond jewels over sapphire jewels, and ascertained that with the increased cost of the diamond jewel it did not warrant the installation of diamond jewels in meters of under 150 amperes capacity. All meters of 150 amperes capacity and over were equipped with diamond jewels, to obtain somewhat better registration on light load. The above, however, only applies to direct-current meters.

20—88. What have member companies found to be the most satisfactory load for meter testing in shop? That is, for single and polyphase meters up to 150 amperes in capacity—the single-phase 110-220 volts and the polyphase 550 volts.

C. H. Ingalls, Edison Electric Illuminating Company of Boston, Mass.—The Boston Edison Company has used for the past several years loads made up of Ward Leonard and General Electric resistance units, each of these units giving about 2½ amperes at 110 volts. All of the load resistances are installed in a vault, to do away with the heat in the testing room. Except for meters over 150 amperes capacity, the testing current has been from 110-volt circuits.

Arthur H. Robbins, c/o The Electric Light and Power Company of Abington and Rockland, Mass.—We use 100-volt load in testing all of our meters, the potential used on the meter being that on which it is designed to operate, namely, 110, 220 and 550.

The General Electric C. R. 188 (Form PM) unit with 2 Cat. No. 58728 holders, make a good load unit. These units are rated according to wattage

and resistance. For loads up to and including 25 amperes load units are used, and for large loads we use an inverted current transformer in connection with above load.

Descriptive matter relating to the above may be obtained from the General Electric Company, Schenectady, N. Y.

F. W. Watts, Hazleton District Superintendent, Harwood Electric Company, Hazleton, Pa.—We are using in our meter-testing shop lamp-bank load for meters up to and including 50 amperes, both single and polyphase, and water rheostat from 50 amperes and above.

H. K. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—We find lamps used in conjunction with a current transformer to be the best and cheapest load for testing all alternating-current meters, both in the shop and on the line.

H. A. Howery, Superintendent Meter Department, Kansas City Electric Light Company, Kansas City, Mo.—On our single-phase, 110-volt and 220-volt meters up to 150 amperes capacity, we have found the following loads to be the most satisfactory: one-tenth of the capacity of the meter for light load, and 75 per cent of the capacity of the meter for heavy load. Light and heavy loads on our 440-volt polyphase meters would be the same.

20—85. What is considered the most correct formula for figuring the percentage of a creeping meter, also the proper method of discounting a customer's bill on same. Take, for instance, a 5-ampere, 110-volt, T. R. W., or Ft. Wayne, Ind., that creeps one revolution in 3 minutes and 20 seconds.

Arthur H. Robbins, The Electric Light and Power Company of Abington and Rockland, Mass.—In the case of the Fort Wayne meter use the formula

$$\frac{100 \times C \times \text{revolutions}}{\text{Seconds}} = \text{watts, for a 5-ampere, 110-volt type K meter of the}$$

induction type. Applying the quantities as given, we get $\frac{100 \times 9 \times 1}{200} = 4.5.$

If the above meter has a load on it, for 4 hours per day, make an allowance on the basis of 20 hours or 90 watt-hours per day.

Considering the T. R. W. meter we will use the formula,

$$\frac{3600 \times C \times \text{revolutions}}{\text{Seconds}} = \text{watts recorded, for a 5-ampere, 110-volt type F}$$

meter. Applying the quantities as given, we get $\frac{3600 \times .3 \times 1}{200} = 5.4$ watts.

Making an allowance for 20 hours per day, we get 108 watt-hours per day.

Wm. Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—A creeping meter only affects a customer's bill at times when no current is being used or when only very light loads are used, therefore when rendering an allowance it is necessary to find out as accurately as possible how many hours per day the installation is idle.

Assuming that the creep amounted to 100 watts per hour, that the installation was idle 14 hours per day, and that the period back to the last test was 90 days, the rebate should be rendered as follows:

100 watts × 14 hours × 45 days = 63 kw hrs. rebate.

It will be noted that allowance has been made to one-half the period between present and previous tests of meter.

H. H. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—The correct formula for figuring creep on any meter is to divide the number of watt-seconds per revolutions of the meter disc, by the seconds required to make one revolution. For instance, a 5-ampere, 110-volt Ft. Wayne Type K meter creeping one revolution in 3 minutes and 20 seconds, which is equivalent to 200 seconds, would register 4.5 watts per hour. In order to discount the above example it would be necessary to know how many hours there was no load on the meter, and then rebate 4.5 watts per hour. In all probability a meter creeping at this rate would be fast, and a certain per cent would have to be allowed on the total kw consumed for the bill in question.

J. Walker Eaton, c/o New York Edison Company, 55 Duane Street, N. Y.—In figuring the amount of creep for the purpose of discounting a customer's bills, it is essential that the number of hours per day this condition continues be known as well as the rate of creeping.

It is commonly the practise to require the inspector or tester reporting the creep to furnish in addition to the rate of creeping in minutes and seconds per revolution, the duration in hours as nearly as this may be approximated.

(The creeping will, of course, not be considered to continue during the hours of the day when any portion of the installation supplied through the meter is in use, as the accuracy of recording during such times is entirely taken care of in the percentage of accuracy on various loads, as shown by the test of the meter; moreover, if the creep is attributable to vibration, it is advisable to ascertain the cause of vibration that an accurate estimate may be made of the time during which the vibration continues and ultimately that the hours of daily creep may be arrived at.)

Having the hours per day the meter creeps and the rate of creeping, the amount of error in watt hours due to creep is decided by the following formula: In the case of a T. W. R. instrument:

$$\frac{3600 \times \text{Test K} \times \text{number hrs. creep per day}}{\text{Rate of creep in sec. per rev.}}$$

Example:

5 amp. 110-volt, 2-wire T. W. R.—K 2 creep at rate of one revolution in 3 min. 20 sec. for 10 hours per day.

$$\text{Substituting—}\frac{3600 \times .2 \times 10}{200} = 36$$

36 = number of watts per day.

It is now only necessary to determine the period over which the allowance is to be extended. The rule, prevailing in the locality, for fixing the period of allowance on fast meters should also govern the period of allowance for creeping.

If the instrument in question is a Fort Wayne meter, the formula to be followed would of course be:

$$\frac{100 \times \text{Test K} \times \text{number hrs. creep per day}}{\text{Rate creep per rev. in seconds}} = \text{the testing}$$

constant used by the Fort Wayne Company, being 36 times the watt-hour constant or 1/100 of the watt-second constant.

The Fort Wayne Company has recently adopted the same formula as the General Electric Company. Therefore in the event of the Fort Wayne instrument being one of a recent type, the first formula should of course be used.

In all cases where allowance is to be made for a creeping meter, which is also fast, the overcharge due to creep should be deducted before figuring the amount of error due to meter being fast.

Frank S. Walton, Philadelphia, Pa.—Creep = 1 revolution in 3 min. 20 sec., or 200 sec.

$$\frac{\text{Revolution of disc or cup} \times \text{test constant}}{\text{Seconds per revolution}} = \text{watts}$$

The test constant being the watt seconds required for one revolution of moving element of meter.

Test constant for 5 ampere, 110-volt, T. R. W. is 1800.

Test constant for 5 ampere, 110-volt, Ft. Wayne, Ind., is 900.

$$\frac{1 \text{ rev.} \times 1800 \text{ test constant}}{200 \text{ seconds}} = 9 \text{ watts creep}$$

9 watts × 24 hours = .216 kw-hours per day.

This amount is deducted from the bill from date of last reading until time creep is discovered.

An allowance of constant creep for 24 hours per day is made.

20—86. What is the practise of operating companies, particularly in the South, in regard to location of electric meters out-of-doors; for instance, under shelter of porches, or in summer kitchens, access to which can be had without disturbing the family. Our temperature frequently drops to 20 degrees Fahrenheit. Summer temperature often reaches 100 degrees. What effect will such temperature changes have upon modern recording wattmeters?

Wm. Rawson Collier, Contract Agent, Georgia Railway and Electric Company, Atlanta, Ga.—Great care should be exercised in the selection of the meter location, especially as to whether or not the meter might be subjected to heavy changes in atmospheric conditions. In this locality we find that atmospheric changes affect the accuracy of the meters a great deal more than the changes in temperature; in fact, the design of the modern watt-hour meter is such as to practically eliminate the temperature change errors. Under no conditions do we think it advisable to install meters in a kitchen, or near a steam exhaust, or in a damp basement. We think that the life of a meter in such locations is very short, and where it is absolutely necessary for them to be located under such conditions, we have them inspected and carefully cleaned once a month.

M. S. Hart, General Manager, Consumers Electric Light and Power Company, New Orleans, La.—Our practise in meter installations is such that we do not recommend installation of meters out-of-doors, under sheds or on porches, as meters should be installed in places that are kept clean and free from dampness, which is not the case when they are outside of the house. We also find that the majority of small installations are controlled by the housekeeper throwing on or off the main switch, as the case may be, and for this reason we do not have much difficulty in having meters installed in one of the rooms.

The inconvenience to the housekeeper in having the meter-reader call once a month is not as great, under these circumstances, as it would be for the lady of the house, or other inmates, having to go on the outside of the house for the purpose of turning on and off the current. We do not find that temperature changes have any effect on our recording watt-meters.

S. J. Halls, Manager Light and Power Department, British Columbia Electric Railway Company, Victoria, B. C.—About 30 per cent of our residence meters are on front or back verandas, and nearly all new houses are wired that way. In dry climate think it good practise, saving meter readers much time. Our average of missed readings is roughly one-half of one per cent. Have only had three cases of meters damaged by dampness in two years. Have about 8000 meters in use, and test same on the premises once each year, bringing all meters in for government test once in five years.

20—87. Is it possible for an electric meter to register accurately for a period, then register too fast for any considerable period, then return to accuracy? If so, at what loads and under what conditions is this liable to occur?

Elihu Thomson, General Electric Company, West Lynn, Mass.—I do not think it is possible to answer an inquiry of so general a character where the electric meter referred to might be an electrolytic meter, a motor meter, either for continuous currents or for alternating currents like an induction meter, or for both. No clue is given to the construction of meter about which inquiry is made, and, of course, a book might be written about the possibilities of all types of meters doing this, that or the other thing. I am making inquiries among our meter men as to the possibilities mentioned. As a general opinion, I might say that a properly constructed meter in good order ought not to do what is stated in the inquiry. The question, however, partakes of the indefinite and hypothetical and can hardly be answered without proper information with regard to the particular meter and the manner of use.

Later:—A suggestion has come from our meter department which would afford a possible answer in the affirmative to the question. If the meter should develop a short-circuit in the resistance in its potential circuit, this would increase the potential circuit current and cause the register to go too fast. If, on further use, this short-circuit finally worked itself out or disappeared, the meter would resume its normal running. That short-circuits do sometimes

disappear in the course of use is a fact based on experience. This whole action would be the result of an accident in some particular meter, and would not apply to any type of meter generally.

C. H. Ingalls, Edison Electric Illuminating Company of Boston, Boston, Mass.—While there are a few theoretical conditions under which a meter might register erratically, as stated in the question, such, for example, as temporary short-circuits and the resistance of the potential circuit of a direct-current watt-hour meter, in actual practise these conditions do not occur without leaving some trace by which they may be discovered.

Joseph A. Dorrian, Private Secretary, Edward Weston, Sc.D., LL.D., Newark, N. J.—I regret to state that Dr. Weston is so pressed with work that it is impossible for him to give the time necessary for a proper analysis and presentation of the facts relating to the behavior of integrating meters, which the question submitted calls for. The matter is an exceedingly complicated one, and different makes and types of meters would exhibit such widely different characteristics that no general answer could be given without danger of misleading the inquirer. I am authorized to say, however, that it is Dr. Weston's opinion that certain forms of integrating meters will behave in the manner indicated. The useless work done in overcoming friction in the meter is more likely to affect the behavior (in the respect inquired about) than is the load.

Wm. Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—Such a condition would indeed be rare and hard to detect. The writer knows of a case where a direct-current meter had been operating accurately for some time, when, suddenly, through excessive vibration, part of the potential circuit had become short-circuited, rendering the meter very fast. The short-circuit cleared itself shortly afterwards, and meter was again accurate.

20--88. Could a 3-wire, 110-220-volt single-phase, unbalanced lighting service be measured correctly with two 2-wire, 220-volt single-phase Westinghouse meters, and if so, how?

C. H. Ingalls, Edison Electric Illuminating Company of Boston, Boston, Mass.—Two 2-wire, 220-volt, single-phase meters may be used to measure a 3-wire, 110-220-volt, single-phase unbalanced lighting circuit by installing one meter in each of the outer wires of the 3-wire circuit and connecting the potential across 220 volts. A true record would be obtained in this case by adding the readings of the two meters and dividing by 2.

W. H. Knierim, Meter Department, New York Edison Company, New York, N. Y.—Yes. Connect the potential coils of both meters in multiple across the outside legs of the system. The series coil of one meter should be inserted in one outside leg and the series coil of the second meter in the other outside leg. The neutral wire should run straight through without any connection whatever with the meters.

The readings of both meters must be multiplied by one-half and then added together. This amounts to taking the mean of the two readings as the actual kilowatt-hour consumption of the system. This method is applicable only on a service which has good voltage balance. The current balance of the customer's load will have no effect whatever on the accuracy of the metering.

Arthur H. Robbins, The Electric Light and Power Company of Abington and Rockland, Mass.—Yes. Cut in the meters on the outside wires. The kilowatt hours consumed are equal to one-half the sum of kilowatt hours recorded by the meters.

Wm. Eichert, Superintendent Meter Department, Edison Electric Illuminating Company of Brooklyn.—A 3-wire, 110-220-volt, single-phase, unbalanced lighting service could be accurately measured with two 2-wire, 220-volt, single-phase meters, although it is an unusual practise.

Connect one meter on each side of system and the potential coils across 220 volts, then divide the dial readings by 2.

H. K. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—Yes, the current in the above example can be measured correctly by connecting the fields of each meter to the outside wire of the circuit, and connecting the potential to the neutral. The meters will only run one-half speed, but the sum of the two will be the correct consumption.

20—89. What is the basic theory upon which period meter-testing schedules are determined?

C. H. Ingalls, Edison Electric Illuminating Company of Boston, Boston, Mass.—In the Boston Edison Company, for direct-current watt-hour meters, all periodic tests are based approximately on a given number of revolutions of the meter disc for each period of test. This is usually taken as 1,000,000, but no commutator meters are allowed to go more than twelve months without test. For induction meters, an arbitrary period of eighteen months for single-phase and six to twelve months for polyphase meters has been adopted.

H. K. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—The basic theory upon which periodic meter testing is determined depends on the make of meter, class of service and capacity. The amount registered is an important factor in deciding upon the period between tests. No rule can be formulated that will definitely fix the time between periodic tests of different capacities. After a meter disc rotates from 800,000 to 1,200,000 it starts to decrease in efficiency as the result of friction, and should be tested before it gets out of commercial accuracy. We test all direct-current meters up to and including 25 amperes yearly, from 25 to 100 amperes semi-annually, and from 100 and including the remainder every three months; alternating-current meters up to and including 25 amperes every two years, from 25 and including 100 amperes yearly, and all over 100 amperes semi-annually.

20—90. What do member companies consider the proper time lag for maximum demand indicators.

H. B. Barnes, Electrical Engineer, 308 Commonwealth Building, Denver, Colo.—The time element for maximum demand indicators used by several of the central stations with whom we are in touch, is set at 90 seconds. These indicators have an inverse time element, *i. e.*, they will record practically the same demand for a certain load existing for 45 seconds as they will record for one-half of this load for 90 seconds. This feature is of value from the customer's standpoint in that it will permit the starting of squirrel-cage motors without recording the sometimes excessive starting energy. The use of a 90-second time element has been perfectly satisfactory in our experience.

Charles A. Stanley, Industrial Engineer, Kansas City Electric Light Company, Kansas City, Mo.—In my experience with three different central stations, the maximum demand meters were set for a lag of 15 to 30 minutes.

COMMERCIAL

21—30. In the Manufacturer's Record of April 22, 1909, Mr. G. U. Borde described a process by which alcohol, acetic acid and stock food to the total value of $33.81 could be obtained from 3200 pounds of dry green sawdust at a cost of $7. With a net value of almost $17 per ton for sawdust, and allowing two tons of dust to one of coal, it would be very expensive to burn the sawdust instead of coal. We have been unable to find any place where this process is used and do not know the first cost of the necessary equipment. If the first cost is high it might be possible to install the equipment in one central mill and let them treat the offal of the other plants in their vicinity. We would like to have the benefit of the experience any of the other member companies have had with this process.

C. H. McClure, Testing Department, Commonwealth Edison Company, Chicago, Ill.—A plant for the manufacture of alcohol from sawdust has been in operation for something over a year at Georgetown, S. C. This plant is operating under what is known as the Ewen-Tomlinson patents. The output at present is about 2000 gallons of ethyl alcohol a day. The capacity of the plant is reported as 5000 gallons per day. The plant is controlled, I understand, by the DuPont Powder Company, and it may be that inquiry addressed to them may yield further information.

In 1903 the Lignum Inversion Company, at that time located in the Roanoke Building, Chicago, published a pamphlet giving some lists and estimates regarding the cost of production of alcohol, acetic acid, etc., from sawdust. I believe this company has gone out of existence.

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—A small advertisement which has proven unusually effective, and, I believe, has the elements of originality. It is taken from an actual night photograph in one of our modest residence streets. It will undoubtedly have the effect of putting on considerable additional desirable all-night business.

21—32. What policy do companies pursue in the matter of advertising in programs and miscellaneous publications of churches, schools, social and political organizations, and the like? Do you consider this type of publicity to have any actual advertising value? Do you consider it worth while to spend a certain amount of money in this way, for the sake of the good-will so gained, or not? Would like to have the practise and opinion of as many companies as possible.

F. H. Gale, In Charge of Advertising, General Electric Company, Schenectady, N. Y.—Regarding the question of advertising in programs and similar local publications, would say that this is the kind of advertising which we find is unpopular with business houses, and in most cities the Board of Trade or Chamber of Commerce has a rule forbidding its members to patronize this class of advertising. The question is one for individual action by each lighting company, but their position is certainly similar to that of department stores in their cities, and we understand that, as a rule, such stores do not buy advertising of this kind.

F. D. Pembleton, Public Service Electric Company, Newark, N. J.—We do not advertise in programs and miscellaneous publications of churches, schools, social and political organizations, etc. We do not believe that this form of publicity produces any real results. We do not spend any money for this form of advertising We depend upon reliable and efficient service to retain the goodwill of our customers and the general public.

H. K. Mohr, Advertising Manager, The Philadelphia Electric Company, Philadelphia, Pa.—The general policy of The Philadelphia Electric Company regarding the matter of advertising in programs and miscellaneous publications of churches, schools, etc., is to refuse all such propositions. We do not consider that this type of publicity has advertising value commen- with

its cost. In addition thereto, being a public utility company furnishing electricity to a great number of schools and churches, it is impossible for us to discriminate between those customers who are getting out publications which have advertising value and those which have not. We are obliged, sometimes, to make exceptions to this general rule, but endeavor to have a plausible reason for such exceptions, so that we can refuse countless other advertising solicitors without giving offence.

J. C. McQuiston, Manager, Westinghouse Department of Publicity, East Pittsburgh, Pa.—Regarding the policy pursued by companies in the matter of advertising in programs, miscellaneous publications of schools, etc., I believe no benefits are to be derived from advertising in these classes of publications, and for that reason we avoid using such mediums.

Douglass Burnett, Manager, Commercial Department, Consolidated Gas, Electric Light and Power Company of Baltimore, Baltimore, Md.—This company has entirely done away with all advertising of this nature. It may have some advertising value, but when the results gained are compared with the money spent it can readily be seen that for a central station company, at least, this class of advertising does not pay.

We do not think it is necessary that a central-station company should try and gain the good-will of the people through any such form of charity. It has been found that when all such advertising is turned down there has been less dissatisfaction among the religious, political and social bodies than heretofore.

B. H. Gardner, Sales Manager, The Dayton Power and Light Company, Dayton, Ohio.—We do not make a regular practise of advertising in programs and other publications of churches, schools, etc. We do not consider this type of publicity has any special advertising value, although it tends to keep your name before the public. In some cases we feel that for a worthy cause it is well to contribute a certain amount in advertising, but we use our judgment as to which publications we take space in and which publications we do not take space in.

Glenn Marston, Dominion Power and Transmission Co., Ltd., Hamilton, Canada.—My own experience has led me to believe that advertising programs and miscellaneous publications are not of sufficiently great commercial value to give traceable results. I use program advertising as a matter of policy when the company is subject to agitations of any specific character, but these can, strictly speaking, hardly be considered as advertising appropriations. I do consider it is worth while to spend a certain amount of money on this sort of advertising, taking very small spaces, merely as a matter of policy, but not with the expectation of getting direct advertising returns.

C. N. Duffy, General Sales Agent, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—We do not advertise in programs, etc., except on rare occasions where there may be some special reason for doing so. Personally, I do not consider this publicity much advertising value, although it does have a value in so far as "good-will" is concerned, but this company has not deemed it good policy to spend a certain sum of money in that way for that purpose.

Louis H. Egan, General Manager, Kansas City Electric Light Company, Kansas City, Mo.—At the beginning of each fiscal year the executive committee of our company decides on what amount shall be expended for advertising during the year. It is our policy to advertise in the daily newspapers, and in the form of carefully edited, artistic pamphlets descriptive of our property and service. We also do a small amount of street-car advertising. We do not advertise in programs or publications of religious, social or political organizations, as in our judgment such publicity has no actual advertising value, and we question the sincerity of the good-will so obtained. Occasionally we consider it inadvisable to refuse certain requests, and meet the situation by making a cash donation in lieu of taking advertising space. The total amount expended in advertising is about three-quarters of one per cent of our gross earnings.

C. W. Lee, New York City.—The practise of advertising in programs and miscellaneous civic and church publications has been discontinued during the past two years by most of the large central stations of the country. It is

acknowledged that sec [illegible] their [illegible] refuse to advertise in such publications [illegible] standing [illegible] with the various organization. [illegible] against the policy of the [illegible] and [illegible] would like it at something [illegible] the [illegible] understand the great [illegible] the [illegible] no resent the refusal.

It is not good [illegible] an annual [illegible] discontinue.

Samuel W. [illegible], Sales Manager, The Edison Illuminating Company of Detroit.—We endeavor [illegible] to get real value out of our advertising appropriation and we do not consider [illegible] miscellaneous advertising as carrying value except in a very few instances. As we are solicited to such a very great extent in advertising of this class, we have found it well to make an absolute rule that we shall not do any advertising of this sort. If we picked out the occasional good one, [illegible] to the charge of favoritism, which we do not wish to incur. We therefore limit our advertising in publications [illegible].

[illegible] H. [illegible], General Sales Manager, The Toronto Electric Light Company Ltd., Toronto, Canada.—We are [illegible] from advertising in all small magazines and miscellaneous publications of churches, schools, social and political [illegible] with the exception of the [illegible]. We do not consider this type of [illegible] as any actual advertising value. Under certain specific cases it is worth [illegible] a certain amount of money for the good-will obtained, but these cases are few and far between.

F. D. [illegible], Commercial Engineer, Union Electric Light and Power Company, St. Louis, Mo.—It is our policy not to advertise in programs of any nature or miscellaneous publications of churches, schools, social or political organizations. All of these mediums are of questionable advertising value and most of them, in my opinion, have practically no value. We find that it is not advisable to spend any money for advertising in these mediums owing to the fact that if an advertisement is placed in one of them, it opens the gates and makes it impossible to place an advertisement in some and not in others without causing complaint and ill feeling. We find that by drawing the line to exclude all such mediums and conscientiously living up to it we are able to explain to our friends and customers who solicit advertisements for such mediums that it is against the policy of the company to advertise in them, owing to the fact that some of the mediums are worthless in an advertising way, and if we selected the mediums with merit and advertised in them, the people soliciting for mediums without merit would not look at it in the same light, due to the fact that we [illegible] solicits advertising unless he considers his medium has merit.

By following the method mentioned, we have been able to refuse the placing of advertisements as stated without causing complaints, because they know we are sincere in our position. Programs gotten out by churches, schools, etc., are usually in connection with bazaars, [illegible], etc., and in such cases we sometimes donate electrical heating appliances for prizes or to be sold. By handling the matter in this way instead of taking an advertisement, the resultant benefits are obvious.

Kingsley Gould Martin, New York City.—It is desirable from every standpoint to carry advertising in miscellaneous publications of strictly local and limited circulation entirely aside from the general periodical advertising campaign.

Large companies that might be considered as immune from the need of such publicity, [illegible] programs, etc., to a considerable extent, as they have learned in the period of their growth that it is often upon the small and seemingly unimportant influences derived from this class of advertising that a large contract or municipal action ultimately depend, whereas a considerable expenditure in other directions might not have the desired result.

Small companies should make large use of these mediums, as the good will of a local organization will carry more immediate weight in the correspondingly smaller community.

The advertising matter itself should be made the subject of considerable thought and should vary in character from newspaper stuff and circulars [illegible]

small printed cards and leaflets used. It should aim to bring about the favorable attitude of the individual group rather than attempt to push the sale of current or of a current-consuming device, although it would not be out of place to call attention to the use being made of a certain piece of commercial electrical apparatus at the function in question, such as a blow motor in a church, ice-cream freezer motor, "postcard projector," etc.

A good line to move on is that used by a well-known New York men's furnisher in the theatre programs, in calling attention to whatever may be the current attraction, and then running in some connecting catchy phrase in regard to his own product. Thus at amateur theatricals, the space taken may read:

OUR COMPLIMENTS ON THE SHOW
BUT—
HAVE YOU EVER THOUGHT OF **OUR**
CONTINUOUS PERFORMANCE?
Any hour of any day or night we are ready
to serve you efficiently and economically.
The Kilowatt Light and Power Company,
Washington Square.

The opportunity must not be overlooked of supplying, where possible, prizes in the shape of electric toasters, curling irons, flat-irons, or for having a coupon serially numbered, incorporated in each "ad.," to be deposited with name and address on the back in a sealed box. Then a drawing should be arranged at the company's office or show room, and the winner's coupon displayed with the prize coffee percolator or similar article, in the window.

The losers should be followed up from their coupons, by letter, perhaps, regretting that they did not win, thanking them for their interest and offering to supply them with service or sell them a duplicate of the prize, etc., as the case may be.

The taking of space in political publications and like mutually antagonistic party documents must be done most discreetly for many reasons that will be appreciated.

C. Nast, Manager Advertising Bureau, The New York Edison Company, New York.—As a rule we do not advertise in any programs of any character, and personally I do not consider them very good advertising mediums. In certain cases it is a good idea to use these publications simply for the sake of their good-will.

D. H. Howard, Advertising Manager, Commonwealth Edison Company, Chicago, Ill.—It is a very rare circumstance to obtain any direct results from advertising in miscellaneous programs issued by churches, schools, clubs, societies, labor and other organizations, race meets, etc., and we would say that these should be looked upon not as legitimate advertising mediums, but any advertising done therein should be considered as a complimentary or politic move.

We are guided in this form of publicity, or charity, you might call it, by the circumstances in each case. Where a church, society, club or other organization is a large user of current it has been our custom to favor them occasionally by taking advertising space in programs, church calendars, cook books, and the like, and the only recommendation which we can give this form of publicity is that it oftentimes results in more friendly relations between company and the consumer, and between company and various organizations.

With public-service corporations, the good-will of the general public is always a valuable asset, and expenditures along the lines indicated are not so large but that value is usually received, if not directly, indirectly. As a rule, however, we do not take advertising space in miscellaneous programs, unless there exists a good reason for our doing so.

We have the services of an information bureau which reports to us relative to the interests behind all such publications.

Nat H. Boynton, Department of Publicity, National Electric Lamp Association, Cleveland, Ohio.—It is the policy of this Association and of the Member Companies of the Association not to advertise in programs and miscellaneous publications of churches, schools, etc. In our opinion, these have very little

advertising value, and in most cases the expense is not attributed to advertising, but is charged to charity. The above is the policy which has been followed in this department and the publicity departments of the individual companies.

Karl A. Schick, Commercial Agent, Rochester Railway and Light Company, Rochester, N. Y.—We do not advertise in programs and miscellaneous publications of church, school or social societies because we do not consider such advertising productive.

We offer, however, in lieu of ads., a gas or electric appliance to be disposed of, with the understanding that winner thereof must reside along the line of our present system of electric lines or gas mains.

We do some advertising in political special publications with a view to holding good-will only. We do not look upon them as productive paying advertising mediums.

John G. Learned, General Contract Agent, North Shore Electric Company, Chicago, Ill.—We do not advertise in programs, or church, school, social or political organization publications, as we do not consider this medium of advertising of any value whatsoever.

We seek the good-will of those interested in these publications by cooperating with them; for example, if a church affair is given we lend our assistance in laying out the lighting and make the installation at actual cost price, or sometimes at a price less than cost.

We realize that it is a difficult matter sometimes to evade the questions of the parties soliciting advertising, but if the reasons are given explicitly in each case we have found that we have not come into disfavor by not advertising in these publications.

L. D. Gibbs, Superintendent of Advertising, The Edison Electric Illuminating Company of Boston, Mass.—The Edison Electric Illuminating Company of Boston gave up the plan of advertising in programs and miscellaneous publications five years ago. It has been a hard fight, but, by reachin gan understanding with other public-service corporations, the writer has succeeded in making the resistance entirely effective.

This type of publicity has, to my mind, no advertising value whatever. The good-will gained is almost entirely ephemeral, inasmuch as those who get up the programs either do it on commission, so have nothing but a selfish interest, or are so fatigued and disgusted when their work is done that they forget all about those who have taken any space in the program.

21—33. A laundry in this city, now renting space, is about to construct a building suitable for its business and is undecided whether to use steam or electricity for power. The managers say that if we can show them one instance where a laundry company has displaced steam with electricity for power purposes, power requirements being about 35 horse-power, and saved money, they would adopt electricity in their new building.

Can any member furnish us the data required?

John Richmond, Engineer, Electrical Department, The American Laundry Machinery Company, Rochester, N. Y.—If the central station interested will write us direct, advising us as to the laundry, we will undoubtedly be able to give them facts in favor or against laundry purchasing current. Decision on this point depends entirely on the class of work handled by the laundry and is entirely irrespective of the amount of horse-power required for power purposes.

H. K. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—The laundry business is one class of service that central stations have failed to secure, especially in such small requirements as 35 horse-power. If this laundry is close to your central station you can handle it. The first thing they will want you to do is to supply them with steam and hot water, and, unless you are close together, you are likely to lose out. The few laundries that are run by central stations to-day are within a block or two of the station.

We have a laundry in this city that has approximately a demand of 100 horse-power, and we cannot land it because they want us to furnish steam and hot water. Every machine in this laundry is electric driven, direct connected, and they have their own plant in the cellar.

22—37. What member companies give off-peak rates? How are these rates controlled, and for what class of service are these rates given? Are there any member companies giving off-peak rates or lower rates for cooking?

(Other replies in December, January, February, March, April and May BULLETINS.)

F. W. Watts, Hazleton District Superintendent, Harwood Electric Company, Hazleton, Pa.—We have on our lines two customers to whom we are giving off-peak rates, one an ice plant and other a water company supplying our city with its water supply. These two companies are given a low rate in consideration of off-peak business, and the hours during which they cannot run in each month are stipulated in the contract which we have with them. Covering a period of two years operating at the present time, we have never had any difficulty with either one running over the time stipulated. However, the water-company contract contains a clause whereby they may operate any of their pumps across our peak in case of serious fire.

S. J. Halls, Manager, Light and Power Department, British Columbia Electric Railway Company, Victoria, B. C.—We give a rate of 5 cents per kw-hour with a monthly minimum of 75 cents per kilowatt connected for electric cooking. Have connected thirty ranges this year. Consumers quite satisfied. We intend pushing this end of the business.

22—53. What is the best reason an electric lighting company can offer for charging $1.00 minimum on lighting meters and $2.50 minimum on power meters?

H. K. Hammond, Head Meter Tester, Scranton Electric Company, Scranton, Pa.—The best reason for charging $1.00 minimum on lighting meters, and $2.50 on power meters, is that the company has to be in readiness to serve the consumers with their maximum demands. This involves a loss in transmission, transformation, metering, maintenance, etc. Without a fixed minimum charge the companies have no guarantee, and would in many cases go into the hands of receivers. This minimum is only a guarantee that the customer will at least used the minimum. Most companies charge for power by the horse-power and not by the meter, the rate being $1.00 per horse-power in many cases. Some companies figure the minimum on the capital invested.

22—54. What instruments (indicating or integrating) are used in determining, or what methods in estimating, the maximum demand of power installations in connection with contracts based on maximum demand?

Gordon Weaver, Industrial Engineer, Kansas City Electric Light Company, Kansas City, Mo.—A number of different methods are used by central stations for measuring the maximum demand. Four different types of meters are used, *viz.*, integrating, recording, indicating and demand.

This company uses an integrating wattmeter and readings are taken every half hour for one operating day. The difference between any two consecutive readings is multiplied by two and the result is the demand in kilowatts for half hour in question. A load curve is platted from these readings and the maximum half-hour demand becomes immediately apparent. In several cases of very large customers, demand wattmeters are used.

Some central stations use the integrating meter for taking the demand where the revolutions per minute of the meter disc is taken when the demand is apparently maximum. Other central stations make tests on the customer's load with a portable testing set (*i. e.*, ammeter, voltmeter and wattmeter) to get the demand on customers up to and including 50 horse-power. Above 50 horse-power, a curve-drawing wattmeter is installed which makes a continuous curve of the load, the paper on which the curve is being drawn moving under the pen at the rate of three inches per hour.

E. M. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—Both the Westinghouse and General Electric Company make indicating maximum demand meters and there are a number of other firms making instruments of this type. The Commonwealth Edison Company uses Wright Demand meters on their direct-current circuits, and where the business is large enough we use, at the present time, a printing meter made by the Minerallac Electric Company of Chicago. This meter prints the kilowatt-hours

consumption at intervals of time predetermined by the company selling the energy. The instrument can be set for any period desired from one minute to one hour, if necessary. In connection with our smaller alternating-current power installations, we are using as a maximum a fixed percentage of the total horse-power installed.

E. J. Richards, General Superintendent, Connecticut River Power Company, Fitchburg, Mass.—We use graphic recording wattmeters on practically all of our customers, so that we get a complete record of their demand at all times. Being practically classed as wholesalers, and our customers all using large quantities of energy, we are justified in taking this expense and find that the graphic records are of great interest in studying the various loads on our system.

Roderick D. Donaldson, The United Gas Improvement Company, Philadelphia, Pa.—I believe the best policy in figuring the maximum demand of power installations is as follows:

For small installations base the maximum demand on estimate.

Under 5 hp., 100 per cent of connected load.
5 to 10 hp., in one motor, 90 per cent of connected load.
5 to 10 hp., in more than one motor, 80 per cent of connected load.
10 to 50 hp., irrespective of motors, 70 per cent of connected load.
Over 50 hp., 60 per cent of connected load.
with 750 watts taken as equaling one horse-power.

On large installations the Chicago Printing Attachment Meter gives excellent satisfaction. This meter gives readings every fifteen minutes, and the largest difference between any two readings will give the maximum demand for the month. One advantage of this meter is that it is not necessary to average the number of peaks for the maximum period, as would be the case with a graphic recording meter. The highest average maximum demand for any fifteen minutes during the month gives a fair maximum demand on which to base the bill.

In the case of small installations the company should retain the privilege of installing some type of recording instrument to measure this demand, as the company would undoubtedly receive considerably smaller demand charges than they were entitled to in some cases.

George H. Jones, Power Engineer, Commonwealth Edison Company, Chicago, Ill.—There are several methods used in determining the maximum demand on power installations as follows:

1. Using as the maximum demand a certain percentage of the total rated horse-power of the motors connected.
2. Actually measuring the maximum demand by means of demand meters of some kind, such as the Wright maximum demand meter, a graphic recording meter or an integrating wattmeter with a printing attachment.

   The Chicago practise is to use Wright maximum demand meters in the case of direct-current installations, and printing meters on large alternating-current installations; while for the smaller alternating-current installations a maximum demand, based on the following percentages of connected load, is used:

Where installations are under 10 hp and only 1 motor is used 85%
Where installations are under 10 hp and more than 1 motor is used 75%
Where installations are from 10 hp to 50 hp, both inclusive (irrespective of number of motors) 65%
Where installations are over 50 hp (irrespective of number motors)..... 55%

The company has, however, the right at any time and from time to time to test the motor or motors connected, and if it be found upon any such test that the actual maximum demand of such motor or motors exceeds the maximum estimated and fixed, then such actual maximum demand shall be deemed to be the maximum demand for the month in which such test is made and for each subsequent month thereafter until again changed by another test.

22—55. Are garage owners in your city paid a fixed amount per automobile charged, or are they paid on the kilowatt-hour basis?

John G. Learned, General Contract Agent, North Shore Electric Company, Chicago, Ill.—The majority of garage owners are receiving a fixed amount per

pleasure vehicle charged. Commercial trucks and transients are charged on the kilowatt-hour basis.

George H. Jones, Power Engineer, Commonwealth Edison Company, Chicago, Ill.—It is customary to charge a fixed amount for automobiles.

L. E. Marshall, Industrial Engineer, Kansas City Electric Light Company, Kansas City, Mo.—Garage owners in this city are paid a fixed amount per automobile charged, instead of being paid on the kilowatt-hour basis.

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—A single charge for a lead battery, thirty-two cells, costs $1.00; batteries with more cells, $1.25; Edison batteries, $1.50. The garages also make a monthly charge for the care and storage of the car, including the charging of the battery, of $25 a month for victorias and open cars, and $30 a month for coupes. Mercury-arc charging sets are, however, in very general use in private garages. These pay $1.00 a month minimum, and a regular power schedule provided by ordinance graduating from seven cents a kilowatt-hour down, on the block system.

MANAGEMENT

23—37. What practical benefit results from the keeping of a perpetual inventory? To within what percentage of being correct has experience proved a perpetual inventory can be kept?

(Also answered in June BULLETIN.)

C. Marden, General Storekeeper, Commonwealth Edison Company, Chicago, Ill.—Card records of perpetual inventories serve many purposes; the most important follow:

1. To show amount of material on hand;
2. To show slow moving and dead stock;
3. To be used in estimating amount of material carried in stock according to previous deliveries.

Card records can be kept from three to five per cent correct on small material and absolutely correct on large items. In keeping these cards it requires the services of an experienced stock clerk.

23—38. How do large companies handle their scrap and spliced wire, and what method is used in accounting for same?

(Also answered in June BULLETIN.)

C. Marden, General Storekeeper, Commonwealth Edison Company, Chicago, Ill.—Where it is possible, we have the scrap hauled into the main or district storerooms, and after we have an accumulation we send out for bids; the party sending in the most favorable bid is the one to whom the scrap is sold.

In order to have a check on this scrap, the foreman on the job weighs the material before sending it to the storeroom and sends in his credit memorandum for the junk in question. The junk is weighed by our receiving clerk, and if there is a discrepancy between his and the foreman's weights, an investigation is immediately started. In weighing out, the junk is weighed by our stock-clerks and the weights are checked by our stock overseer.

23—40. Is it or is it not good practise to eliminate meter readings from monthly electric light and power bills so that bills only show the net kilowatt-hours, rate and amount in money? What companies now practise this method?

(Other replies in June BULLETIN.)

S. J. Halls, Manager, Light and Power Department, British Columbia Electric Railway Company, Victoria, B. C.—Canadian regulations call for meter readings to be left with consumer. Believe it is good policy; know from personal experience that many people keep strict tab on their monthly consumption.

23—41. In order to arrive at a proper estimate of our own condition in this respect, would like to learn from companies what is the ratio of complaints to the number of customers supplied?

R. F. Pack, Secretary and Comptroller, The Toronto Electric Light Com-

pany, Ltd., Toronto, Canada.—The total number of complaints received of excessive charges, poor voltage regulation, incivility, etc., is as follows:

Date	Number of Complaints
1910—June	113
July	108
August	96
September	133
October	257
November	407
December	386
1911—January	430
February	352
March	181
April	143
May	129
	2,735

Number of complaints in year	2,735
Average per month	228
Total number of customers	15,000
Percentage	1½

E. J. Bowers, General Accountant, Kansas City Electric Light Company, Kansas City, Mo.—The Kansas City Electric Light Company has approximately 18,000 customers in Kansas City, Mo. During the summer months the number of complaints run from 150 to 200 per month. During the balance of the year, including winter months, they are considerably higher and run from 200 to 450 per month, so that 1 per cent of our customers complain during the summer months and approximately 2½ per cent during the winter months. This does not include, however, instances where customers call in person regarding the period covered by the billing or balance owing on account, or for other information which pertains more or less to the clerical end of the business.

S. J. Halls, Manager, Light and Power Department, British Columbia Electric Railway Company, Victoria, B. C.—Our complaints are approximately one-tenth of one per cent. With good service, proper meter inspection and careful readers, believe our complaints are down to a minimum.

Douglass Burnett, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—The complaints of the past twelve months aggregate as follows:

Generation	6
Distribution	537
Application	90
Customers' equipment	1880
Bill complaints	3356
Total	5869

Total number of customers, average for the year, approximately 18,000.

Ratio complaints per year to customers, about...... 30 %
" " " month " " 2½%

Complaints from customers are encouraged by the company in every way and it would seem from the above figures that one out of every three complaints has to do with the customers' equipment. These complaints might more properly be called reports of defective conditions, and customers call upon us to assist in remedying them. The term "complaint," in general, refers to any matter in connection with the company's service that the customers desire to have taken up, rather than a case where the customer considers the company at fault.

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—In this city the portion of business enjoyed by this company amounts to about 30,000 consumers, and all complaints would not exceed one-half of one per cent a year. We have a special agent who takes care of these

complaints and who goes to any length to make a friend and satisfied consumer out of the complainer. We have been very successful in this work, and do not hesitate to take the short end of the deal, as we think it pays in the long run.

Walter R. Boyd, Manager Lighting Inspection Department, The New York Edison Company.—During the year 1910 complaints were received amounting to a trifle over one-half of one per cent of the bills rendered. This is somewhat better than the previous year—complaints received then being approximately three-quarters of one per cent of the bills issued. The falling off in the percentage of complaints received is due, I believe, to our being able to more promptly communicate with the customer, resulting in a more satisfactory relationship with the general public. Promptness and courtesy is of the utmost importance, creating a friendly feeling between the customer and the company—thereby to a large extent reducing the number of complaints.

23—42. I would be glad to get some information on the revenue to be expected from residence connections having various numbers of lights.

H. C. Deffenbaugh, Rochester, N. Y.—From a recent study of 300 residence consumers, selected at random from all parts of the city, we found the average income per year to be as follows:

Connected Load	Income per Year
5 16 candle-power lamps	$15.25
10 " "	17.00
15 " "	19.00
20 " "	21.00
25 " "	23.30
30 " "	25.80
35 " "	28.50
40 " "	31.50
50 " "	38.70
60 " "	47.70
80 " "	68.80
100 " "	92.50

The rate paid by the above consumers was 8 cents per kilowatt-hour, subject to the following minimum guarantee:

Minimum charge up to and including 50 16's or equivalent, $1.00 per month; from 50 to 100 16's, $2.00 per month.

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—At a base rate of seven cents per kilowatt-hour with a minimum of $1.00 per month, this company estimates the annual revenue from a residence to be $1.00 per lamp installed. A comparison of the estimated with the actual results covering a period of several years has completely justified our estimates. Of course, this applies only to residences with more than twelve lamps, as no residence pays less than $1.00 a month minimum in any case.

23—44. What division do member companies make of the turbo-electric generator for purposes of accounting, i. e., what, if any, proportion should be charged to the steam plant, and what, if any, proportion should be charged to the electric plant?

I have run across this question in connection with the appraisal of electric properties and am somewhat at a loss to know just what to do.

P. Junkersfeld, Assistant to Second Vice-President, Commonwealth Edison Company, Chicago, Ill.—The Commonwealth Edison Company, both in its investment and operating accounts, separates all charges in connection with the turbo-generator into two parts, steam and electrical. There is no absolutely fixed proportion for all sizes and types of units, this being arrived at separately in each type and size. In some cases the electrical portion has been as low as 33 per cent and others as high as 50 per cent.

J. L. Bailey, Chairman, Committee on Uniform Accounting, National Electric Light Association, Baltimore, Md.—In my experience there has never been any real occasion for a division in accounts, looking to the cost of operation of the different types of motors. It can readily be seen that if this were called for, it would be necessary to have a division of cost accounts for every type

of generator, subject also to further division in capacity, etc. From an accounting standpoint, the question is taken up as the cost of generation, no attempt being made to regard the efficiency of such apparatus. This, in my opinion, is an engineering and not an accounting problem. In a plant supplying an even continuous load, the ratio of steam to electric proportion of a machine would probably differ materially from that operating a system of high peaks, where great overloads may be necessary, so that it would be a very difficult matter to determine a ratio of cost that would meet all demands, due to this disparity of operating conditions and character of loads and various central stations. As a rough estimate of the relative costs of the electric and steam end in a turbo-generator, it is thought that the electric end will cost in the neighborhood of one-third of the entire machine, that is, about one-half of the steam end.

Henry Floy, Consulting Engineer, New York.—As there would be no difficulty in obtaining from the manufacturing company the division of the price paid for a steam turbo-generator unit—usually about two-thirds of the total for the steam end and one-third the total for the electric end—there should be no difficulty in proportioning the total investment in a turbo-electric generator for proper accounting.

If the correct division of the total price is made, it would probably be advisable to apply a somewhat higher rate for annual depreciation on the steam end than that which is applied to the electric end of the unit, as experience indicates that the life of the steam end will be shorter than that of the electric end.

24—57. What experience have member companies had in keeping a partial or complete photographic record of all employes?

(Other Replies in May BULLETIN.)

Sydney W. Ashe, General Electric Company, Harrison, N. J.—The General Electric Company at Harrison has been in the habit of taking a photograph, which is mounted on the reference card of the individual, for each new man that enters the organization.

We have found this card very useful in keeping track of our men, especially when any matter pertaining to the man's interest is under discussion, and it is desirable to show the personality of the man, as well as his educational and practical training. Reproduction of same is shown on next page.

24—61. What member companies hold regular meetings of their employes or department heads?

S. J. Halls, Manager, Light and Power Department, British Columbia Electric Railway Company, Victoria, B. C.—We hold regular monthly meetings of department heads. Spend half a day alternate months going over equipment and evening in session. Think it a splendid idea, especially where operating in various towns and municipalities.

24—62. Will member companies having mutual aid or benefit societies kindly advise what percentage of the available employes are members of such society?

(Other replies in June BULLETIN.)

W. L. Bruce, Claim Agent, Westchester Lighting Company, Mount Vernon, N. Y.—There has been in existence for the past three years a Mutual Aid Society composed of employes of this company, and membership is about 60 per cent of the available employes. The lighting company contributes to the funds of the society one-half the amount received from the members for dues. Monthly dues are 50 cents per member, and there is no initiation fee. The society pays a sick benefit of $6.00 per week, and a member is entitled to this amount after he has been sick a week. The death benefit amounts to $100. One must be a member of the society six months before he is entitled to benefits.

Sick benefit is not allowed a member for a period exceeding ten weeks in any one year.

When members leave the employ of the lighting company, there is refunded to them 75 per cent of the amount received from them for dues, less any amount

which they may have been allowed for sick benefits, and their membership ceases in the society. Should a member resign from the society and still continue to be an employe of the lighting company, no refund of dues is made.

SALESMAN'S RECORD

Full Name Alden G. Stevens.

Date December 27th, 1910.

Permanent Address 90 Hudson Street

Age 25 Weight 150 Height 5'-10"

Dominant Characteristic Conservative

Personality

Educational Training Yale S. S. S. Sanitary and Civil Engineer

Practical Experience None

Sales Experience Newspaper Soliciting

References Mr. Frederick L. Ford City Eng. Hartford, Ct. Mr. David L. Houpe, Pres United Eng. Co. 17 W 42nd St. N. Y.

EXPERIENCE OBTAINED AT HARRISON:

From	To	Work Carried On

	SALES													CONTRACTS SIGNED												
Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
191																										
191																										
191																										
191																										
191																										

SALESMAN'S RECORD CARD, G. E.—See Answer to Question 24—57.

24—68. Has any member company experience with more than one kind of addressograph? If so, which one gives the best results? We require a new one almost at once. Number of accounts struck off daily, 1500, and a daily average change of 45 names and addresses.

J. H. Gulick, Auditor, Commonwealth Edison Company, Chicago, Ill.—We have used the Addressograph Company's chain record and are now using their card index record, which we put in about two years ago. We find this more satisfactory and very much cleaner, gives far better results in printing and is more elastic in every sense of the word, and for sorting purposes and changing names is most convenient and eliminates waste of time in comparison with the chain record.

R. B. MacCreery, Philadelphia Electric Company, Philadelphia, Pa.—We have had no experience with any other addressing machine than the Addressograph. Our machine is of motor-driven type, using card index type metal frames with three-line link and sliding rubber type.

Machine has been in use for about six years and about 1500 bills are printed daily, beside the printing of envelopes at various times for mailing of advertising matter, etc. Also we take care of an average of 15 changes and 50 additions daily. All the above work is handled by two boys.

The results produced by this machine have always been most satisfactory, we therefore have had no occasion to experiment with other makes of machine.

but, on account of space required for filing of address links, we will, no doubt, in the near future change over to the Metal Plate Card Index type of the same concern, using stamped metal plate addresses instead of setting same up with rubber type. It is also claimed that this system, once installed, is less expensive (changes and additions) than the old method.

24—65. Will member companies operating in towns where colleges are located furnish information as to the method of metering, billing, etc., for dormitories? Have prepayment meters been used, and with what success, in cases where company deals directly with students. Are deposits required when owner doesn't guarantee accounts? If owner does guarantee accounts, and rooms or suites are metered individually, is service sold at less than regular rates?

F. D. Adams, Treasurer, The United Illuminating Company, New Haven, Conn.—We have furnished Yale University dormitories with light for a great many years. We do our business direct with Yale University and not with the students. In some cases we have one meter covering an entire building, and in other cases we have a meter in each apartment. We do not insist on any deposit. Once in a great while we have students apply for current who are in private houses. If we are not acquainted with them we require them to pay a meter deposit, if the owners will not guarantee the account. We sell the current at our regular meter rate of 10 cents per kilowatt-hour.

H. J. Gille, Commercial Agent, The Minneapolis General Electric Company, Minneapolis, Minn.—We are furnishing current for the dormitories at the University of Minnesota which is furnished at our regular residence rate. Current for these dormitories is paid for by the University of Minnesota.

E. A. Barrows, Secretary and Treasurer, Narragansett Electric Lighting Company, Providence, R. I.—The method this company pursues is to furnish the college memorandum meters, but to throw the responsibility of all collections on the college, the current being billed to them in bulk.

We, however, have one private dormitory in which the current is billed to the individual. In this case we have found it expedient to require a deposit of $5.00 from each customer.

John G. Learned, General Contract Agent, North Shore Electric Company, Chicago, Ill.—We are operating in one university town and serve the dormitories and residences of those associated with the university the same as we would other customers.

We closely scrutinize the credit of the students, and if we are doubtful as to same, insist upon a deposit, and, in extreme cases, we have installed prepayment meters.

We are of the opinion that it is poor policy to furnish service at a rate less than standard.

24—66. Do any companies fill in gaps on premises where the house-wiring terminations do not meet the service entry? Please give particulars as to distance, limits of concessions, etc.

F. W. Watts, Hazleton District Superintendent, Harwood Electric Company, Hazleton, Pa.—We send out typewritten copies of rules and regulations to all wiring contractors in towns and cities supplied by our service, giving our rules and regulations covering inside wiring and what a contractor must do to wire a house for connection to our service. In rare instances, where the contractor has overlooked running the service wires from the main switch out of the building, we will bore the necessary service holes and enter our service wires to the main switch.

24—67. On what basis do you make extensions arising in the ordinary course of business? Do you demand advance payment of a certain part of the cost by the prospective customer as an evidence of good faith, and if so, how much? What percentage of first-year revenue to cost is required before making extensions without charge to consumer? Do you repay customer his prepayment, and, if so, how?

Douglass Burnett, Manager, Commercial Department, Consolidated Gas, Electric Light and Power Company, Baltimore, Md.—Following are extracts

from the company's "Sundry Terms and Conditions—Main Extensions and Service Connections."

MAIN EXTENSIONS are made when rights-of-way and conditions satisfactory to the company obtain, at the company's expense for labor and material, to a distance of not exceeding twenty feet for overhead extensions, or two feet for underground extensions (within territory occupied by the municipal house-to-house distribution duct system), for each sixteen candle-power carbon lamp equivalent of original installation. The extension is measured in every case from the end of the existing main in a direction parallel to the thoroughfare or right-of-way to a point opposite the service entrance to the customer's property. For greater distances, the customer shall pay the company in advance, the estimated additional cost of the extension, based on the cost per foot of the entire length of extension, which payment shall be refunded, in the event of any additional installation being connected to the same extension, at the same rate. All extensions installed by the company shall remain the property of the company.

SERVICE CONNECTIONS. Where street mains are available at a point in public thoroughfare opposite the customer's premises, the company will make service connections at its expense, subject to the following limitations:—In overhead districts not over ten feet per lamp and one hundred feet of overhead service connection inside the property line to the point of attachment to the customer's structure. In underground districts (in territory occupied by the municipal house-to-house distribution duct system), not over twenty-five feet length of underground service inside the property line to the service switch. The customer shall pay the cost of all additional construction required to complete the service connection in either case, together with all rentals of any ducts on the customer's property. All service connections installed by the company shall remain the company's property.

E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—Our practise in connection with line extensions is as follows:

If it appears that the revenue from the business secured will equal the cost of the extension in two years' time, we will make such extension without deposit or guarantee, provided the consumer's business is established and we are reasonably sure that he will use a full quota of electricity in the period mentioned. In case there is any doubt as to the customer using this amount of energy, we ask a deposit covering the cost of the extension and refund the customer the total amount on a basis of giving him full credit on each alternate monthly bill until the whole amount has been returned to him.

We sometimes run line extensions into territory that shows evidence of rapid building up without being sure that our expenditure will be returned in two years. Occasionally we require customers to guarantee a monthly minimum bill based on the line-extension cost, this minimum to insure us the return of the money expended in two years. Our attitude in the matter depends largely on the conditions surrounding the case.

L. F. Philo, Sales Manager, Union Electric Light and Power Company, St. Louis, Mo.—Extensions arising in the ordinary course of business are made by us without charge to the customer, if the estimated yearly revenue will equal the expense of constructing the line. If the extension seems justified by reason of prospective business that we expect to get in the near future, no charge is made. Where the above conditions do not govern, customer is asked to sign up on our cost and refund basis, which provides that he pay us for the entire cost of extension, same being refunded to him on his subsequent monthly service bills in small installments.

Joseph F. Becker, Sales Manager, The United Electric Light and Power Company, New York.—The United Electric Light and Power Company makes extensions to all prospective consumers who will make a prepayment of 60 per cent of the cost of construction, or, in the event of the business involved netting a revenue per annum equal to the cost of construction, no prepayment is asked. In case a prepayment is made, same is refunded in sums equal to 50 per cent of the customer's monthly bills, until the entire amount has been returned to him; also, on any additional business that may be secured along the line of extension, he will receive credit to the amount of 50 per cent of all

the additional connected installations, which will be applied to his prepayment until the entire amount has been refunded.

S. M. Sheridan, Sales Manager, The Edison Illuminating Company of Detroit, —The policy in Detroit is very liberal in extensions of lines. We make all extensions without cost to the customer, and if the request for extension is in a growing neighborhood we always meet the demand.

Wm. Rawson Collier, Georgia Railway and Electric Company, Atlanta, Ga.—In making extensions in residential districts we have an estimate made and charge the customer two-thirds of the cost of material, plus cost of labor, less $10 for each residence contract that we obtain on the line at the time of the extension. We also agree to rebate the customer $10 for each future customer that we attach to the line within the term of two years, up to and including the total amount paid for the extension. In almost every case the original customer, therefore, obtains in rebates an amount equivalent to the original amount that he paid for the extension.

In making the extensions in the underground districts a charge is made, unless we estimate revenue enough to warrant a free extension. As a general proposition, but one not strictly followed by us, I would say that if the first year's revenue amounts to 50 per cent of the extension cost, the extension is made free to the customer. In the case of underground cut-ins, we do not rebate the customer except in exceptional cases.

O. M. Rau, Superintendent Electric Lighting, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.—With reference to service extensions our policy is to make the extensions into rapidly developing sections without any cost. Whenever service extensions are required into districts which we do not consider will develop rapidly our basis for making such extensions is that they pay for one-half the total cost of the extension, which amount will be rebated, provided the gross income from this extension will amount to the total cost of the line within two years.

E. R. Davenport, Sales Manager, Narragansett Electric Lighting Company, Providence, R. I.—After the construction department has furnished us with figures, showing cost of construction, labor, material and line instruments necessary to serve the customer, we estimate the probable yearly income. If this income is more than 20 per cent of the construction charges and the business is to be permanent, we will connect the customer free of charge; or if the customer is willing to guarantee yearly a sum equal to 20 per cent of the total charges for a period of five years or a larger proportional amount distributed over a shorter period.

We do not demand advance payment except in the case of enterprises of doubtful credit, which is equivalent to a deposit to guarantee payment of the account, and also write a clause in the agreement with customer that bill shall be paid weekly or monthly when presented.

R. G. Gentry, The Denver Gas and Electric Company, Denver, Colo.—Where an extension is necessary, one pole and one span of wire, covering a distance of 110 feet, is allowed free of charge for each consumer, he guaranteeing to use $15 in light the first year. Any excess poles required necessitate a cash deposit of $15 per pole. The said deposit may be refunded on the consumer's monthly bill or when an additional consumer is added to the extension within the first year's period. Special cases are taken up in the usual way where changes in the above requirements are made.

M. S. Hart, General Manager, Consumers Electric Light and Power Company, New Orleans, La.—It has been the policy of our company, wherever business indicated an adequate return on investment, to make extensions without any payment or obligation whatsoever on the part of the consumer. We have been rather liberal in this policy, and believe that such a one will rapidly build up the business of any company. We believe that if the cost of any extension is returned to the company, in the way of revenue, within a period of two years, that the company should make these extensions without any cost to the consumer.

H. J. Gille, Commercial Agent, The Minneapolis General Electric Company, Minneapolis, Minn.—We make extensions on the basis of an investment of $2.50 for $1.00 estimated revenue for the first year, current furnished at our regular rates.

S. M. Kennedy, General Agent, Southern California Edison Company, Los Angeles, Cal.—For lighting extensions in the municipalities where we are doing business, it is customary to extend upon the basis of one pole to each consumer in the residence districts. However, we are not insistent as to this rule, and usually make extensions in residence districts upon a liberal basis.

In the outlying districts, both urban and suburban, and where new tracts are being opened up, the owners of which are desirous of obtaining electric service on their properties, we collect the estimated cost of the extensions and agree to refund the amount collected upon the basis of $20 for each new consumer connected for lighting or power service from the extension made. This plan seems to work out satisfactorily, both for the company and those interested in receiving the electric service.

Another basis upon which we consider extensions in the suburban or rural districts, both for light and power, is that the first year's income shall equal at least 50 per cent of the cost of the proposed extension. As a matter of fact, this might be considered our rule in these matters outside of the limits of the numerous municipalities.

C. E. A. Carr, General Manager, The Quebec Railway, Light, Heat and Power Company, Quebec, P. Q.—We have no set rule in reference to extensions and the question is one that greatly interests us. At the present time if we erect any poles on private property to enable us to reach the applicant's premises for light or power, we charge the cost or a large proportion of same to the consumer. This rule also applies where extensions are made on public highways where the chances of business are slim.

William A. Donkin, General Contracting Agent, The Alleghany County Light Company, Pittsburgh, Pa.—For each new customer we will place one pole or extend two sections of wire, without charge to the customer.

We do not require any advance payment except where there is a question as to the customer's responsibility, in which case we require the entire amount.

We do not confine ourselves to any particular percentage of the first year revenue, as our contracts are made for from one to five, or more years, and the desirability of the business, together with the yearly revenue, determines the expense to which we would be justified in going in order to make any extension to connect such customers. If the revenue does not justify us in making the entire extension at our expense we require the customer to pay a certain portion of the cost of the extension.

Ordinarily we do not refund any cost of connections. However in some instances, where the expense is considerable and paid by the customer, we arrange that in the event of future business developing and supplied from this particular line, we reimburse the customer proportionately.

J. T. Maxwell, General Agent, The Philadelphia Electric Company, Philadelphia, Pa.—The line below which the company assumes extension investment and above which the consumer assumes the investment has not been sharply defined.

Where the volume of business justifies the company assuming this investment, it may be provided for in several ways.

If the consumer's standing does not justify the company assuming the expenditure, then the consumer is required to pay for the investment to be refunded to him periodically.

If the consumer's credit is good, the company assumes the investment immediately, and the contract for current is made for a term of years, depending upon the expenditure.

In the event of discontinuing service previous to the full term specified in the contract, then the consumer is required to pay to the company a pro rata amount of said investment. For instance, if the contract is for a term of three years, and the consumer discontinues at the end of the first year, he is required to pay two-thirds of the amount of the investment. If he discontinues at the end of the second year, he pays one-third, and if he continues for the full period, the company assumes the entire investment. The investments above referred to do not refer to motor or wiring investments made in the consumer's premises.

Thomas F. Kelly, Contract Agent, The Hamilton Electric Light and Power Company, Ltd., Hamilton, Canada.—The practise of this company in the ordinary

course of business is to make extensions when the estimated revenue for one year is 50 per cent of the cost of the extension. In some cases we have extended our lines where the cost of the extension has exceeded this amount by requiring the customer to pay the difference in cash; in other cases we have secured from the customer five-year contracts and divided the difference into 60 payments, one of which he pays with each monthly light or power account during the five years. In many cases where the cost of the extension is slightly in excess of the first two years' revenue this is approved of, provided the chances of securing business in the next two years are by any means bright. In the majority of cases where our first year's estimated revenue is not 50 per cent of the extension cost we secure two, three, four or five-year contracts, sell the current at regular meter rates, but apply a minimum charge high enough to secure us the cost of the extension during the first half of the term of the contract. We have used all of these different methods to the customers' and our satisfaction. In no case where the customer has paid a portion of the cost of the extension in any way, either by cash payment or extra fixed or minimum charges, is the amount ever returned to him.

A. N. Richardson, General Superintendent, Kansas City Electric Light Company, Kansas City, Mo.—The practise of this company is to make extensions it deems desirable without cost to the customer. Undesirable extensions that cannot well be avoided are made on the basis of the customer paying net cost above $60 with the provision that $60 be credited to customer's account for each additional connection to the line, until the entire deposit is cancelled.

C. S. Walton, District Agent, Southern California Edison Company, Los Angeles, Cal.—In answering this question it seems necessary and desirable to lay stress upon the conditions existing in this city. It has been growing at a phenomenal rate for the past twenty years without any interruption. Everybody uses electricity freely. The rates are very low. Practically every residence in the city is wired, and there are very few vacant houses.

Under these conditions we have been called upon to make extensions very liberally. We are glad to make an extension when the estimated annual income amounts to 40 per cent of the total cost of the extension, service connection, and meter and lamps. On this basis, however, the growth of the city would be greatly retarded, as oftentimes a new tract is opened up which requires costly extensions, and the first few houses on this tract would have to wait for a long time before getting electric service. In order to cover cases of this sort a city ordinance has been in force for several years which compels the company to make any extension requested upon the payment of a deposit of the cost of the poles, wires, etc., but not including transformers. This deposit is credited to a special account called "Pole Deposit," and is refunded to the party making the same at the rate of $20 for each house containing fifteen or more sixteen candle-power lamps, or their equivalent, which may be connected to the extension within a period of three years.

This company has made hundreds of extensions on this basis, and the result has been entirely satisfactory to both parties. It simply means that the party opening up a new tract puts up the cost of the extension, and as fast as the tract fills up the amount is refunded, so that the company really carries the proportion of cost for houses built and occupied, while the land-owner carries the vacant lots. Many of these extensions have become profitable within the first year and the entire amount of the deposit refunded.

From the company's point of view the cost of connecting up one of these houses is a refund of $20 on account of the deposit, and a charge of, say, $20 more for the cost of service, meter and lamps. The ordinance has been the means of providing a basis on which this class of extension can be made with justice to all concerned, and has proven highly satisfactory both to the property owner and the company, and has removed the friction which sometimes arose before its passage.

24—68. When the service to a consumer is changed from alternating current to direct current, or vice versa, does the central station pay entire cost for any necessary change in consumer's equipment?

E. W. Lloyd, General Contract Agent, Commonwealth Edison Company, Chicago, Ill.—We have done very little of this changing in the past few years.

A number of years ago, when we changed from 500-volt service in part of our territory to 220-volt service, we stood part of the cost of changing over, depending in large measure on the condition of the equipment that was removed. Where it is a case of simply changing lighting service, we generally stand what expense there is in connection with this.

Douglass Burnett, Manager, Commercial Department, Consolidated Gas, Electric Light and Power Company of Baltimore, Baltimore, Md.—When the service to a customer is changed from alternating to direct current or *vice versa*, as such changes are made only at the company's option, the company pays the entire cost of any necessary change in customer's equipment; when, however, a customer is changed from overhead to underground service on the order of the municipal authorities to the company to establish service from the city duct system, then the customer has the responsibility of changing the wiring to accord to the change in the method of supply; though should, in connection with such change from overhead to underground, the class of current also be changed, the company changes the equipment only in so far as the change is called for by the change in the class of current.

Peninsular Electric Light Company, Detroit, Mich.—We have changed a number of customers in both directions. We have frequently found it practicable to get some credit for superior value of new equipment furnished in place of old equipment; for instance, we have found it possible to get about one-third the price for a new motor furnished in place of an old one; but, in general, we have found it necessary and politic to pay the entire cost of any change of equipment.

J. T. Maxwell, General Agent, The Philadelphia Electric Company, Philadelphia, Pa.—When the service to a consumer is changed from one class to another, the company usually pays the entire cost of the necessary change in the consumer's equipment.

One exception to this rule is where the apparatus has deteriorated to such an extent as to require replacement at an early date. It is to be presumed that the consumer has provided for a depreciation, which should be used in this replacement.

L. L. Elden, Superintendent Department of Electrical Engineering, The Edison Electric Illuminating Company of Boston, Mass.—It has been the custom of the Boston Edison Company to make all such changes free of expense to the consumer. This has included changes in wiring, changes in motors and special apparatus, also changes in service wires—in fact, anything which has been necessary to place the customer's service on the same basis it was before the company made the changes.

MISCELLANEOUS

0—37. Do any member companies have "blown" fuses refilled, and if so, how do they assure themselves that work is properly done? Are there any concerns that refill fuses with the approval of the Board of Underwriters?

(Other replies in June BULLETIN.)

D. W. Roper, Assistant to Chief Operating Engineer, Commonwealth Edison Company, Chicago, Ill.—This company has for many years made it a practise to refill their Edison plug fuses. Standard fuse wire is used for the purpose and the work is done by a man in our repair department. We do not know of any concern that makes a business of refilling these fuse plugs.

0—40. The writer, a young man, would like some information as to the best method of fitting himself for the management of a central station in a growing town of 5000 people. He has charge of the office (we also operate an ice plant), but knows practically nothing about electricity. The business of the plant is rapidly increasing. The writer is financially interested, and is in line for managership later on, if he can make good. How much technical knowledge is necessary, and how can I best obtain it, without giving up my work? Do you know of a good correspondence course? Or any good books for "beginners"? Also, how can I best get the A-B-C of central-station practise?

Charles P. Steinmetz, A.M., Ph. D., Schenectady, N. Y.—The more technical knowledge the manager of a central station possesses, the better it will be for

him and the station. The best way of gaining some technical knowledge without giving up his work appears to me to study in a correspondence school, and I should suggest that the young man get the catalogue of courses of the Scranton International Correspondence School, and from there pick out those courses which appear appropriate for his prospective position.

I do not know of any good book for beginners, and do not think much is to be gained by reading so-called popular books, but it appears to me by far preferable to take a systematic course in a correspondence school.

Arthur H. Robbins, The Electric Light and Power Company of Abington and Rockland, Mass.—Several of the larger colleges conduct evening courses, some of which I understand afford exceptionally good opportunities for the busy man to obtain an electrical knowledge.

If the inquirer cannot take advantage of a course as above stated, he will probably be able to get a great deal of assistance from a correspondence course. The International Correspondence Schools of Scranton, Pa., have several good courses. They will gladly send descriptive matter upon request.

Chas. F. Scott, Consulting Engineer, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.—This is a difficult question to answer. The following points, however, may be pertinent:

Whether a young man knowing practically nothing of electricity can fit himself for the managership of an operating company depends very much upon the man himself. A man with intelligence, industry and common sense, which qualifies him for managership, should be able to acquire the necessary technical knowledge. While he need not become a high-grade engineer, he may be able to handle the ordinary matters which arise and to recognize when to call for expert engineering services from others.

A course in a good correspondence school should supply the necessary fundamental knowledge. The circulars and instruction books of large manufacturing companies give a fund of definite information regarding the apparatus with which he will have to do. Occasional trips of inspection to other plants and discussion with the superintendents and operating men will be of obvious value as sources of information, suggestion and comparison. Presumably the manager of a small plant needs to know when his station is operated properly. He need not enter very far into the engineering features of the various steam and electrical machinery, as the general engineering can be done by others when additions are made. He does not need to be familiar with line construction and the installation of apparatus on customers' premises, because these are the things which are constantly arising and which must be handled by the man in charge. Many of the papers and reports, and particularly the *Question Box* and the *Solicitors' Handbook* of the National Electric Light Association afford a rich field of information upon which such a man can draw for information and assistance.

A man who is to manage a plant ought to know the details of its operation at first-hand. If he has been in the boiler-room, engine-room and dynamo-room; if he has been with the men who do line work and install meters, he will know what is involved in these operations, he will know when such work is efficiently done, and will understand the point of view of the men who do work of this kind. A sort of apprenticeship in which the man works for a time in each department would be a most excellent training. If he cannot give all of his time to it, evening hours spent in the station—preferably with overalls, firing boilers—at least being with the men, getting acquainted with them, seeing what their work is and how they do it, as well as becoming familiar with the machinery itself, will be of great benefit later on.

In the foregoing it is assumed that the young man cannot spend any time at school. A short practical course would be found very helpful.

The foregoing may serve as a specific answer to the question.

Presumably there are many men in somewhat similar positions throughout the country. A definite course of instruction, with more intelligent supervision and direction, would be highly beneficial and helpful. Possibly there might be organized in connection with the National Electric Light Association a sort of correspondence school to aid such men. It would probably not be necessary to prepare lesson papers, but rather to recommend particular courses in corre-

spondence schools or particular articles for reading and study appropriate to the particular case. This is somewhat along the same general line as the Company Sections, but it would be more definite and specifically helpful to the individual who wants to progress, and such individuals are apt to make the best men in the long run.

1—10. What is the best kind of paint for our stacks, gas holders, and water stand-pipes? We have had experience in painting stacks and pipes, only to find the result unsatisfactory and the work to do over. Also is it wise to paint the inside of a smoke stack before erection?

(Other replies in June BULLETIN.)

W. H. Norris, Philadelphia Electric Company, Philadelphia, Pa.—We have no gas holders nor water stand-pipes, but we find the best paint for steel stacks is graphite paint of the very best quality that can be obtained. The stack must be thoroughly cleaned before the graphite paint be applied, otherwise the result will not be very satisfactory.

We have tried a great many other paints, but in cases where the stack is subjected to a pretty high heat, a graphite paint seems to be the only one that will last for any length of time. It should always be applied by a practical painter and not by one of the so-called "Steeple Jacks." These are men who are not painters at all, but who are expert climbers and put the paint on with the largest and coarsest kind of brush that can be obtained, without the exercise of any skill at all. We have tried, in a few cases, such people, but have always had to do the work over again in a very short time.

NEW QUESTIONS

0—41. Would like information as to dry kilns used for steam drying hollow concrete tiles and blocks, referring to
(1) Construction of kiln.
(2) Arrangement and amount of steam piping.
(3) Amount of heat required.
(4) Amount of moisture required.

0—42. (a) What are the present standards of series lighting?
(b) What is the best-known method of voltage and current regulation for alternating current series arc and incandescent jointly, and what is the best method for series arc alternating current, as well as for series incandescent alternating current regulation, separately.
(c) What is the usual established potential of such circuits?
(d) What is the usual "rule" governing the number of lamps per circuit?
(e) What efficiency of regulation is the best known to have been secured?
(f) Is series incandescent lighting apparently on the increase or wane?
(g) Are tungsten lamps seemingly tending to increase series incandescent lighting? Why, if this increase is apparent, is it more desirable now than in the past?
(h) What is the method of locating regulator with regard to the circuit to be regulated?
(i) What is the usual current flow of series incandescent lighting of modern practise?
(j) Ditto arc?
(k) Is there any apparent tendency to bring about a change in any of these conditions, and, if so, what is the tendency?

0—43. Can any data be furnished regarding recent developments in fighting fires of a nature peculiar to the central station? Has there been any liquid extinguisher developed that will deal efficiently with electrical fires? Dry powder has been found of very little use and the ordinary liquid extinguisher cannot be used on "live" apparatus.

12—58. What has been the experience with wooden top steel pins on wood cross-arms and poles with 13,000-volt, 3-phase lines.

12—59. What companies have experienced troubles on 4-K.V. distribution lines as follows:—A short circuit occurs from some known cause, such as a kite string or a piece of baling wire, which burns the line down. Upon inspection the line is found down, not only at the point where the trouble occurred, but also at one or more places between that point and the station. What causes the additional shorts? Is it the rule or the exception for them to occur?
What is your average span; the distance between wires; the average sag?

12—60. What has been found to be the best form of ground or earth connection, aside from that of gas or water mains, for grounding transformers, lightning arresters and the like?
Has any ground resistance been determined or fixed as a unit above which it is not desirable to go?
Has anything been determined that would lead to the standardization of grounding methods? If so, what is it?
I know that ground points and ground plates and various other such methods have been used, but I am endeavoring to learn if any engineers or operators have made experiments and tests to establish certain fixed methods.
Any information that I can secure along this line will be highly appreciated.

12—61. I would like some information on source of the following trouble: In case of heavy thunder storms in our part of the country, to which we are subject during the summer months, many fuses are blown on transformers in

different parts of town. Primary conditions are as follows: 3-phase power lines, 2300-220 volts; 3-phase and single-phase lighting circuits, 2300-110 volts. Our lines are protected with the best type of General Electric primary lightning arresters on the primary side. In spite of this we are much bothered by the blowing of primary fuses during storms. I do not understand how the lightning arresters allow the current to get through the transformer. Would appreciate information or suggestions on the subject.

12—62. We have had trouble with aluminum arresters after they have been in service six or twelve months, apparently due to deterioration of electrolyte "oil or cone."

At point of contact of oil and electrolyte the aluminum shows brown stain, as of rust, and slight pitting. The arc at charging tends to yellow, and increases in intensity with repeated charging, instead of being snappy and blue. The electrolyte changes from pale yellow to cloudy white. Manufacturer reported electrolyte used as pure. Every precaution was taken in original installation and regular charging.

Would appreciate prompt reply as to probable cause and remedy, and experience of other operators.

Manufacturers have not offered satisfactory solution, and either cannot or will not admit cause for fear of liability.

Trouble has in three instances caused short-circuits between horns. In one instance arc jumped from cone to metallic case. Have vertical barriers been found necessary between horns, where horns are in building and subject to cross currents of air between windows?

13—27. This company is making a study of any tendency toward electrolysis which may exist on its return railway circuits, and, in this connection, would greatly appreciate any information as to the methods in use by operating companies in

(a) Detecting the presence of electrolysis.
(b) Keeping records of tests for use in court, or otherwise.
(c) Preventing or minimizing electrolytic conditions.

Should also like to obtain, if possible, a record of any court decisions in this country, regarding the liability of street railway companies for damage by electrolysis to water and gas mains.

15—61. What companies make a practise of testing line transformers as received from the manufacturers? What tests are made? What per cent fail in the test? What is the proportion of failure in the various tests?

16—43. Have any of the member companies experienced any trouble with Magnetite arc lamps owing to the electrodes welding together, and, if so, have they discovered any means of preventing same?

18—7. What experience have member companies had with instantaneous water heaters for the various uses to which they would be put in residences?

20—92. Two generating stations, five miles apart, are operated in parallel. At times it is desired to shut one of them down and let the other carry the load of the entire system. There is a 3-phase meter connected in the line between the two stations and located at one of the stations. It is desired to have the meter run in a positive direction when station No. 1 is furnishing energy to station No. 2, and backwards when the energy is going in the reverse direction. What meter connections would cause the meter to run in a positive direction regardless of which station was operating, except under certain load conditions? What would these load conditions be?

20—93. Is it possible to connect a 3-phase, 4-wire meter with three current transformers and two potential transformers in circuit so that it will register too much. If so, how?

21—34. What methods are member companies pursuing (in connection with securing residence business) for the wiring of residences? What arrangements, if any, are made with contractors for doing this work on a cost basis?

21—35. Will member companies give a description of any plant on their lines where oxygen is produced electrolytically? What precautions are taken

against possible explosions, what voltage is found necessary across the electrodes, what fraction of a kilowatt-hour input to the M. G. set is necessary to liberate one cubic foot of oxygen at atmospheric pressure, and what use, if any, has been found for the hydrogen?

21—36. What average rates of depreciation do power salesmen apply to prospective private plants of the following types?

1. Steam plants:
   (a) High-speed simple non-condensing.
   (b) Simple Corliss non-condensing.
   (c) High-speed compound non-condensing.
   (d) Steam turbine non-condensing.
2. Boiler plants with piping and auxiliaries, with
   (a) Fire-tube boilers.
   (b) Water-tube boilers.
3. Producer-gas plants.
4. Oil engines.
5. Gas and gasoline engines.

What is a fair estimate of the cost of oils, cleaning materials, packings, gaskets, and other minor supplies per year, per horse-power for the above types of plant of 50, 100 and 200 horse-power capacity?

22—56. We are immediately interested in the matter of an equitable rate for office-building lighting.

We have recently closed contract with a big building of this city for their power and also for their lighting. They expect to distribute the lighting to their tenants and they want to arrange to charge them some equitable rate, avoiding, at the same time, the expense of installing individual meters.

We are furnishing them with 2200-volt alternating current for a motor-generator set and also alternating current for lighting direct from our lines.

Our minimum rate for lighting is $1.20 per month, net, and I thought that it would be possible to base this price on, say, so many lights connected or so many hours per day carrying with it the minimum and for any increased use of light or any increased connected load, the cost of lighting would increase proportionately.

There are several office buildings in the city, and, in the majority of cases, they are on our lines, but the tenants carry their own electric accounts and we have individual meters installed, so that we must be very careful to see that the proper contract is obtained in this particular case so as to avoid confusion.

We would be glad of information as to lighting contracts being used under similar conditions. Of course current for fans and lights and all appliances should be taken care of.

23—46. Will member companies operating in cities of approximately 250,000 inhabitants kindly advise:

Number of customers.

Number of employes in accounting department, specifying number of billing clerks, ledger clerks, etc.

23—47. How do large companies keep a record of reels.

23—48. What are off-peak hours? To what percentage of the maximum load can the day load rise, and the customer be allowed to use his demand and still be considered as being off the peak? What argument can be given in support of an arbitrary percentage so chosen?

I appreciate that such factors as a combined railway and lighting load, and geographical location with respect to a certain meridian, affect peak hours, and answers should eliminate such factors.

23—49. Do companies who supply free carbon or Gem lamp renewals find that the use of the tungsten lamp has reduced the amount of their free lamp-renewal account, and, if so, to what extent? Also would like to have information as to whether tungsten lamp sales are increasing, and, if so, to what extent?

24—69. In a town of about 12,000, where there has been no competition, is it desirable for the central station to endeavor to secure a gas franchise which is about to be let, the management not being familiar with the gas busi-

ness, or is the fact of there being competition likely to produce a sufficiently better feeling toward the electric company to compensate for the competition?

24—70. We have a plant of 1200 horse-power capacity, and for six or eight hours each day during the summer months our load is very light.

We have all the exhaust steam available and could furnish power at a very low rate. We would like to have your suggestion as to some manufacturing which would utilize heat and cheap power and the services of an engineer during the summer months.

24—71. What method do large companies use to distribute periodically to their own outside employes, electrical contractors, solicitors of manufacturers and others, exact information as to locations of their lines and nature of current available at each location?

24—72. What office hours do companies have, week-days and Saturdays? During what months do companies close early on Saturdays?

24—73. What is the practise of member companies in the purchase of electrical machinery from the large manufacturing companies in regard to testing? Where several duplicate machines are purchased, are fuel tests, including complete heat runs, etc., required on every machine, or is one machine only tested and the others of the same design accepted on the data obtained from the one tested?

24—74. What member companies give monthly men, other than those that are employed in the offices, a vacation with pay?

24—75. The cost of meter maintenance, meter reading, billing and collecting is a very heavy proportion of the cost of supplying service to residence consumers. Would it not be better to read meters and bill such consumers every two or three months instead of every month?

27—1. We have under consideration the outside lighting of a building. This will be outline work, and we propose to use 4 candle-power, 5-watt Mazda lamps, 12 volt, using the multiple series system of wiring on direct-current. Direct current is the only thing available, and the use of about 1200 lamps for this purpose will mean multiple groups of 120 lamps each, these groups to be placed in series across 115-volt direct current. We do not know of any such installation, but would like to have opinions as to the feasibility of this wiring scheme and the use of tungsten lamps in this way. Would appreciate recommendations and suggestions, and any reference to outline lighting system using this method of wiring.

Repeated Questions

The following recent questions have received no reply or else it is felt that further replies are called for and would be of value. Members are urged to respond with the information requested. Those marked with an asterisk appear here for the last time.

0—39. What comparative experience have member companies had with the two methods of resuscitation from electric shock, and what is the advice of medical men regarding the advantages of the so-called prone method and the method of laying the person on his back and working his arms to induce respiration?

7—7. Will some member company, who has low-pressure turbines, kindly furnish some data on the following proposition:

If a reciprocating engine and generator carrying 3200 kilowatts with a 28-inch vacuum takes a water rate of 18.9 pounds per kilowatt-hour, what would be the water rate if a low-pressure turbine was connected to the engine, exhaust vacuum remaining the same, and the engine-driven generator delivering its full 3200 kilowatts and the low-pressure turbine delivering approximately 2000 kilowatts?

7—8. Will member companies who have Parson's Type Turbines kindly give experiences they have had with steel blading and with steel, copper-plated blading, also, member companies who have Curtis Turbines give experiences they have had in regard to trouble with nozzles and blading corroding?

10—49. We have a 225-kilowatt, 2300-volt, 60-cycle, 2-phase, revolving-field Walker alternator, direct-connected to a four-valve, tandem-compound engine. After running this generator ten or twelve hours, it begins to lag and refuses to carry over two-thirds of its rated capacity, and after running 24 hours, will not carry more than one-half its capacity. It does not get excessively hot, and the exciter maintains its average at all times. We wish to know if any member can advise us the cause of this trouble, and how it can be remedied, and if shortening the air-gap will have any effect on this.

12—54. What experiences have member companies had with the ordinary portable testing sets, connected up for the Murray loop test in locating faults in power cables?

12—55. Have the special sliding bridges made for locating faults on power circuits been found to have any advantages over the ordinary testing sets?

12—56. What experiences have member companies had in locating faults where the conductor has burned clear of the ground by using capacity measurements?

12—57. We wish to inquire if any member companies have had experience in repairing the decayed butts of wooden poles by the use of reinforced concrete? If so, has this proven a successful method of preventing any further decay? Please give all the information available concerning the subject of repairing the decayed butts of poles, whether with concrete or any other method.

13—26.—Have any definite figures been obtained, showing the comparison of life between the new fibre conduit used in underground construction and the old iron-pipe conduit?

14—7. Have any member companies had any experience with the Edison Battery for vehicle work? Would certainly appreciate any information we can get on this subject.

15—59. Would like information from member companies as to experience had in fusing the secondaries of transformers operating in parallel on a three-wire, low-tension distribution system, the transformers being located some distance apart?

16—38. Wanted: Data or tests on street gas lamps of the present type in use; something that would compare with a 40- and 80-watt tungsten series lamp.

16—41. What experience, if any, have member companies had in the use and installing of the 400 and 500 watt Mazda units, as to life and methods of installing?

20—76. Will some member company give information in regard to rewinding Type C and J. N. Thompson recording wattmeter armatures? Would like all information, if possible, including method.

20—84. What is the opinion of member companies as to the practicability of a selective relay used in conjunction with, or as an attachment to, service meters, for the purpose of reducing the rate of current supplied for domestic current-consuming devices, during the "off-peak" load period? This relay would be operated at definite intervals from the station switchboard without interrupting the service.

20—85. What is considered the most correct formula for figuring the percentage of a creeping meter, also the proper method of discounting a customer's bill on same. Take, for instance, a 5-ampere, 110-volt, T. R. W., or Ft. Wayne, Ind., that creeps one revolution in 3 minutes and 20 seconds.

20—86. What is the practise of operating companies, particularly in the South, in regard to location of electric meters out-of-doors; for instance, under shelter of porches, or in summer kitchens, access to which can be had without disturbing the family. Our temperature frequently drops to 20 degrees Fahrenheit. Summer temperature often reaches 100 degrees. What effect will such temperature changes have upon modern recording wattmeters?

20—90. What do member companies consider the proper time-lag for maximum demand indicators.

20—91. It is desired to adopt a maximum demand rate for small lighting consumers. Is there an inexpensive 3-wire demand indicator on the market that could be used for this purpose?

21—14. In the advertising campaigns of central stations there is frequently one particular piece of advertising which has been especially effective in producing replies or attracting attention. The writer would be grateful if member companies would forward any such, and the editor of the "Question Box" has agreed to publish any of extra value that can be shown in small compass.

21—23. A laundry in this city, now renting space, is about to construct a building suitable for its business and is undecided whether to use steam or electricity for power. The managers say that if we can show them one instance where a laundry company has displaced steam with electricity for power purposes, power requirements being about 35 horse-power, and saved money, they would adopt electricity in their new building.

Can any member furnish us the data required?

23—43. We are beginning to feel that we are imposed upon by many of our customers in the matter of lamp renewals—possibly supplying neighboring towns, etc. The writer knows that some companies arrange their lamp renewals on a basis which gives a card to each customer, which card has to be presented when lamp renewals are requested. The card shows each exchange so that the company can keep tab on the number given to that particular customer. We would like to have sample cards which are in actual use, if you can secure them for us.

23—45. Will those companies supplying towns of 50,000 and over, kindly advise the cost per 50-watt lamp equivalent or kilowatt of securing new business, said cost to include advertising and soliciting? Also please advise to what account this expense is charged.

24—64. Have any member companies made any attempt to introduce the Taylor system of scientific management into any department of their power plants, or any other department of their organization; if so, what have been the results?

24—66. Do any companies fill in gaps on premises where the house-wiring terminations do not meet the service entry? Please give particulars as to distance, limits of concessions, etc.

25—9. Have any member companies had suits brought against them for damages, where the question of defective insulation of ordinary weatherproof wire materially entered into the case?

28—2. Would like information from member companies in large cities where they are using ornamental iron poles for high-voltage series arc circuits, from underground source of supply, as to what make of pole is used. Would like to have names of such, so that we may correspond with them.

28—3. Have any member companies substituted tungsten lamps for arc lamps for street lights in sizes less than 250 and 500 watts, and, if so, what sizes have they used, and have they staggered the placing of the lamps or have they placed them opposite each other? Also what prices have they obtained from the municipalities for the different sized units? Are the citizens pleased with such form of lighting as compared with the former method of lighting by arc lamps?

National Electric Light Association

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